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(54) POLISHING MATERIAL FOR DRY BLAST PROCESSING

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a polishing material which can effectively prevent troubles caused by water such as the coagulation or agglomeration of the polishing material, or the adhesion of the polishing material to an article to be polished, and can achieve high polishing efficiency and high processing accuracy.
SOLUTION: The polishing material is characterized by treating the surfaces of spherical inorganic particles with a water repellency-imparting substance.

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CLAIMS

[Claim(s)]
[Claim 1] Abrasives for dry type blasting characterized by coming to carry out surface preparation of the matter which gives water repellence to a spherical inorganic particle.
[Claim 2] Abrasives for blasting according to claim 1 which come to add the fluid amelioration agent which consists of 1/10 or less mean particle diameter of the mean particle diameter of a spherical inorganic particle 0.01 to 5% of the weight to a spherical inorganic particle.
[Claim 3] Abrasives according to claim 1 or 2 with which a spherical inorganic particle is satisfied of following type (1) - (3).
Ten <=A<=0.8C (1)
0.02 C<=B<=0.5C (2)
50<=C<=1000 (3)
However, A: The maximum particle diameter of a spherical inorganic particle (micrometer)
B: Mean particle diameter of a spherical inorganic particle (micrometer)
C: The grinding minimum flute width (micrometer)
[Claim 4] Abrasives given in any 1 term of claims 1-3 used for removal of the oxide skin of a semi-conductor.
[Claim 5] Abrasives given in any 1 term of claims 1-3 used for formation of the rib material to the tooth-back substrate top of PDP.
[Claim 6] Abrasives given in any 1 term of claims 1-3 used for formation of the scribe line for series connections of a solar battery element.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to abrasives excellent in polish effectiveness and process tolerance while preventing effectively troubles, such as adhesion in condensation of the abrasives resulting from moisture, union, and a ground object, in more detail about the abrasives using a spherical inorganic particle used for dry-type precise sandblasting processing.
[0002]
[Description of the Prior Art] Blasting is the industrial technique used widely, in order to inject an abrasives particle on the surface of a workpiece at high speed, to carry out

grinding of the workpiece front face, or to remove the dirt adhering to a front face, or to give impulse force to a workpiece front face and to improve the property of the front face. Recently, it is increasingly used for processing of the detailed field this technique of whose is several 10 micrometers which was not considered conventionally. For example, the sandblasting method is taken up as leading technique by the approach of forming the septum of a plasma display panel (it is hereafter described as PDP), and, partly, it is in a practical use phase. A low-melting-glass layer with a thickness of 1mm or less which has blasting nature is formed on the glass substrate with which the electrode was prepared, and grinding of a detailed slot called width of face of 50-1000 micrometers is carried out to this low-melting-glass layer by Mr. Fukashi of the electrode on a glass substrate or a glass substrate. In this case, by injecting and carrying out blasting of the abrasives to the front-face side of a masking tape, a flute width carries out grinding of the low-melting-glass layer, and forms a septum. This diaphragm is calcinated at a next process and serves as an inorganic glass septum. It is referred to as PDP for a fluorescent substance etc. to be installed in the space between this septum.

[0003] moreover, the conductor which set two or more solar battery elements to the manufacture of a solar battery which carries out series connection electrically, sprayed the particle fine particles which are abrasives as a gas stream on each electric conduction film, such as transparence electric conduction film in which opening was formed by the predetermined pattern as an approach of separating and accumulating for every solar battery element, a photo-electric-conversion layer, and a rear-face electrode, and was exposed to opening -- the sandblasting method for carrying out the scribe of the film is tried. The sandblasting method is tried by the detailed grinding for similarly obtaining electric connection of the Bahia hall processing, oxide skin removal of a semi-conductor circuit element, etc. for the multilayer-interconnection plate by which high density assembly was carried out.

[0004] By the sandblasting method used for removal of the oxide film of electrodes, such as septum formation of the above-mentioned PDP tooth-back substrate, or a solar battery, or a semi-conductor, with grinding waste (the paste material or coat formation object by which grinding was carried out), the injected abrasives are eliminated from a grinding part, acquire separation processes, such as a screen, are collected, and are primarily stored in a reservoir tank etc., and a reuse is carried out to blasting. As an abrasives particle, according to the purpose, the glass bead of various presentations, an alundum, corundum, a ceramic bead, stainless steel, copper, etc. are proposed, and it is used actually. Such particle shape is made desirable [the configuration near a globular form or a globular form].

[0005] It is that removal of a big and rough particle is easy in the manufacture process of abrasives as an advantage for which the particle of the configuration near a globular form or a globular form as abrasives is used, and there is no adhesion to the workpiece in blasting, a fluidity is good, and there is little wear of abrasives.

[0006] however, ** et al. and a mean diameter -- several 10 micrometers - several micrometers the conveyance circuit of the abrasives from service tanks once a fluidity was not good or suspended equipment, even if the configuration of a metaphor abrasives particle was very close to the real ball when inorganic abrasives were used for the sandblasting method, when it is going to reboot after a while to a nozzle -- on the way -- the case where come out and it stops flowing at all happens. In such a case, if an impact

is added to a choked part, abrasives may start a flow, but after carrying out disassembling equipment etc. and eliminating all the abrasives in equipment, in many cases, a part or all will be changed to new abrasives, they will reboot to them, and serve as remarkable trouble at workability and productivity. Especially, it has two or more nozzles (abrasives injection part), and great time amount and a great effort are needed for exchange of abrasives with the large-sized blasting machine incorporating the recovery system of abrasives.

[0007] Since lock out of abrasives takes place also with the equipment with which the policy of destaticization was given, this cause is presumed to depend liquid bridge formation on starting between each contact section of an abrasives particle, or some detailed grinding waste and abrasives particles considering maldistribution with moisture [minute amount / during blasting or a halt] with time as a lifting and a result.

[0008] That is, in sandblasting processing by the blasting machine, abrasives are injected at high pressure and a high speed from an injection nozzle, in a nozzle point, the low-temperature part by injection arises and the waterdrop by the temperature gradient occurs in a nozzle point. And the case which abrasives condense with the moisture after a blasting machine halt and in this machine is often generated. Moreover, especially, in a large-sized sandblast cleaning machine, in order to reboot the abrasives in a nozzle point and a machine by condensation of the abrasives in a machine, and solidification, it must once discharge out of a system. When a machine exists in a clean room, such activities not only reduce productive efficiency, but will reach to an extreme of difficulty. Moreover, the moisture generated in the injection nozzle point of a blasting machine acts as a binder of abrasives, and the case which the phenomenon in which abrasives adhere to a grinding-ed object front face generates is also reported.

[0009] On the other hand, it compares with a flute width like septum formation of PDP. In grinding with a deep channel depth If grinding progresses to some extent and a slot is ****(ed) although an abrasives particle is a configuration near a globular form or a globular form therefore In order that an abrasives particle may collide with a groove face side on the contrary in the groove bottom section of a ground object, there is also a problem that the configuration of a septum (or slot) cannot become fixed easily (a side edge becomes large). Although it is considerably improvable if the injection pressure of abrasives is weakened, scouring velocity will be sacrificed for this problem as a result.

[0010] Furthermore, the present condition is that qualitative selection is performed about the magnitude of an abrasives particle from detailed processing being difficult since the curvature of an abrasives particle is large etc. although a bigger abrasives particle has larger scouring velocity since mass is large. However, abrasives should have the grain-size configuration whose process tolerance can enlarge working speed highly according to the configuration of a workpiece.

[0011] As mentioned above, by micro processing by the sandblasting method, abrasives with sufficient working efficiency are called for with the fluidity of the abrasives which become an important factor about working efficiency, the fluid reservation especially at the time of a reboot, process tolerance, and the dissolution of the side edge which influences both working efficiency and high degree of accuracy.

[0012]

[Problem(s) to be Solved by the Invention] This invention is what was made in view of the above-mentioned actual condition. The technical problem Cancel the above-

mentioned trouble and it is especially used for removal of the oxide skin of semi-conductors, such as grinding of septum formation processing of PDP, and the scribe line of a solar battery, etc. suitably in dry type. While precision can improve grinding efficiently, without spoiling the description of a workpiece pars-basilaris-ossis-occipitalis front face, it is in offering the abrasives which can reboot also after preventing condensation of the abrasives particle resulting from moisture, for example, suspending the blasting machine between one whole day and night at least.
[0013]
[Means for Solving the Problem] this invention persons by carrying out surface treatment of the matter which gives water repellence to a spherical inorganic particle, as a result of inquiring wholeheartedly The condensation by the liquid bridge formation resulting from the moisture of an abrasives particle is prevented. For example, the abrasives which can reboot also after suspending a blasting machine above one whole day and night can be offered. A fluid improvement furthermore, by controlling a scale, the grinding minimum flute width (micrometer), the configuration of abrasives, the maximum particle diameter, mean particle diameter, etc. by adding the particle which consists of 1/10 or less diameter of particle diameter to an abrasives particle Ultra-precision machining reached a header and this invention in usable abrasives in the required semi-conductor field etc.
[0014] That is, the abrasives for dry type blasting characterized by this invention coming to carry out surface preparation of the matter which gives water repellence to a spherical inorganic particle are made into the contents (claim 1). In addition, in this invention, vocabulary called grinding is used as vocabulary which also includes shot blasting besides grinding.
[0015] They are the abrasives according to claim 1 which come to add the fluid amelioration agent which consists of 1/10 or less mean particle diameter of the mean particle diameter of a spherical inorganic particle 0.01 to 5% of the weight to a spherical inorganic particle as a desirable mode (claim 2).
[0016] As a desirable mode, spherical inorganic particles are the abrasives according to claim 1 or 2 with which are satisfied of following type (1) - (3) (claim 3).
Ten <=A<=0.8C (1)
0.02 C<=B<=0.5C (2)
50<=C<=1000 (3)
However, A: The maximum particle diameter of abrasives (micrometer)
B: Mean particle diameter of abrasives (micrometer)
C: Grinding or the minimum flute width which carries out shot blasting (micrometer)
[0017] As a desirable mode, they are abrasives given in any 1 term of claims 1-3 used for removal of the oxide skin of a semi-conductor (claim 4).
[0018] As a desirable mode, they are abrasives given in any 1 term of claims 1-3 used for formation of the rib material to the tooth-back substrate top of PDP (claim 5).
[0019] As a desirable mode, they are abrasives given in any 1 term of claims 1-3 used for formation of the scribe line for series connections of a solar battery element (claim 6).
[0020]
[The gestalt of invention implementation] Hereafter, this invention is explained to a detail. This invention can be characterized by being the abrasives for dry type blasting characterized by coming to carry out surface preparation of the matter which gives water repellence to a spherical inorganic particle, can prevent effectively condensation of the

abrasives by the liquid bridge formation between particles which originates in moisture by this, union, or adhesion in the workpiece of abrasives, and can raise grinding effectiveness and grinding precision sharply.

[0021] As a spherical inorganic particle used for this invention, spherical inorganic particle fine particles, such as a glass bead, an alundum, corundum, a ceramic bead, stainless steel, and copper, are mentioned, for example. In this invention, the rate of area to the circumscribed circle of particle projected area says 80% or more of case more preferably 50% or more so that it may be defined as spherical by the following formula (4).

$$\text{外接円に対する面積率（\%）} = \frac{\text{粒子の投影面積}}{\text{粒子投影面積の外接円の面積}} \times 100 \quad (4)$$

[0022] It can use without being limited especially if it is the matter which gives water repellence as matter which gives the water repellence used for this invention. When it illustrates concretely, oleic acid, a lauric acid, a myristic acid, isotridecyl myristate, AMAIDO and bis-AMAIDO of the fatty-acid; aforementioned fatty acid, such as a palmitic acid, behenic acid, stearin acid, and isostearic acid; The higher-fatty-acid ester of higher alcohol, such as stearyl alcohol, or branching higher-alcohol; monohydric alcohol, Fatty-acid-ester system lubricant, such as higher-fatty-acid ester of polyhydric alcohol, very long-chain montan wax type ester, or its partial hydrolysate; Barium stearate, Calcium stearate, aluminum stearate, zinc stearate, Metallic soap system lubricant, such as magnesium stearate or its complex; A 16 or more C liquid paraffin, A micro crystallin wax, native paraffin, synthetic paraffin, Aliphatic hydrocarbon system lubricant, such as polyolefine waxes and these partial oxidation objects, a fluoride, and a chloride; A silicone oil, Soybean oil, palm oil, palm kernel oil, the linseed oil, rapeseed oil, cotton seed oil, tung oil, Oils;HLB, such as castor oil, beef tallow, squalane, lanolin, and hardened oil, nine or less surfactant, For example, carboxylate, such as N-acylamino acid chloride, alkyl ether carboxylate, and acyl peptide; An alkyl sulfonate, Alkylbenzene and alkylnaphthalenesulfonate, sulfone succinate, Sulfonates, such as alpha-olefin sulfonate and N-acyl sulfonate; Sulfated oil, Alkyl sulfate, alkyl ether sulfate, an alkyl allyl compound ethereal sulfate salt, Sulfate salts, such as an alkylamide sulfate; Alkyl phosphate, alkyl ether phosphate, Anionic surfactants, such as phosphate, such as alkyl allyl compound ether phosphate; Alkylamine salt, Aliphatic series quarternary ammonium salt, a benzalkonium salt, benzethonium chloride, Cationic surfactants, such as pyridinium salt and imidazolinium salt; Carboxy betaine, Amphoteric surface active agents, such as aminocarboxylate, imidazolinium betaine, and lecithin; Polyoxyethylene alkyl ether, The ether 2nd class alcoholic [of a polyoxyethylene], polyoxyethylene alkyl phenyl ether, The polyoxyethylene sterol ether, a polyoxyethylene lanolin derivative, The ethylene oxide derivative of an alkylphenol formalin condensate, a polyoxyethylene polyoxypropylene blockpolymer, Polyoxyethylene polyoxypropylene alkyl ether, polyoxyethylene glycerine fatty acid ester, Polyoxyethylene castor oil and hardening castor oil, polyoxyethylene sorbitan fatty acid ester, Polyoxyethylene sorbitol fatty acid ester, polyethylene glycol fatty acid ester, A fatty-acid monoglyceride, polyglyceryl fatty acid ester, polyglyceryl fatty acid ester, A sorbitan fatty acid ester, fatty acid

alkanolamide, a polyoxyethylene fatty-acid-ester amide, System-of-reaction surfactants, such as the nonionic surface active agent; fluorochemical surfactant; polyoxyethylene ARIRUGURISHIJIRU nonylphenyl ether, such as polyoxyethylene alkylamine and an alkylamine oxide; Gamma-chloropropyltrimetoxysilane, Vinyltriethoxysilane, vinyltrimetoxysilane, a vinyl tris (beta-methoxyethoxy) silane, Gamma-methacryloxpropyl trimethoxy silane, beta-(3, 4-epoxycyclohexyl) ethyltrimethoxysilane, Gamma-glycidoxypropyltrimetoxysilane, gamma-mercapto propyltrimethoxysilane, gamma-aminopropyl triethoxysilane, N-beta-(aminoethyl)-gamma-aminopropyl trimethoxysilane, Silane coupling agents, such as gamma-YUREIDO propyl TORIECHIKISHI silane; Isopropylisostearoyl titanate, Isopropyl tree n-dodecylbenzene sulfonyl titanate, isopropyl tris (dioctyl PIROHOSU fight) titanate, tetra-isopropyl bis(JITORIDESHIRUFOSU fight) titanate, Tetrapod (2 and 2-diaryl oxymethyl-1-butyl) bis(G tridecyl) FOSU fight titanate, Titanium coupling agents, such as bis(dioctyl pyrophosphate) ethylene titanate and isopropanal PIRUTORI (N-aminoethyl-aminoethyl) titanate, are mentioned, and these are independent, or they are combined two or more sorts and used. Cheap stearin acid is desirable especially.

[0023] The amount of surface treatment of the matter which gives water repellence has 0.01 - 5% of the weight of the desirable range to a spherical inorganic particle, and its 0.1 - 4 % of the weight is more desirable especially. Even if the amount of surface treatment of the matter which gives water repellence does not have the enough surface treatment effectiveness at less than 0.01 % of the weight and, on the other hand, exceeds 5 % of the weight, it is not not only economical, but the surface treatment effectiveness may not improve but it may spoil the physical properties of a ground object on the contrary.

[0024] By carrying out addition mixing of the fluid amelioration agent which becomes the above-mentioned surface treatment particle from 1/10 or less mean particle diameter of the mean particle diameter of a spherical inorganic particle, the abrasives of this invention raise further the fluidity in a blasting machine, and the dispersibility of the abrasives at the time of blasting, and it becomes possible to make the residual property to the workpiece at the time of blasting termination reduce further of them. If a fluid amelioration agent is illustrated concretely, the end of superfines, such as talc, a silicic anhydride, a bentonite, a kaolin, a magnesium oxide, a magnesium carbonate, a magnesium silicate, a zinc oxide, a magnesium hydroxide, colloidal silica, diatomaceous earth, magnesium stearate, fused silica powder, fumed silica, a silica, cornstarch, starch, and a calcium silicate, will be mentioned, and these are independent, or they will be combined two or more sorts and will be used. A silicic anhydride and colloidal silica are desirable at the point that an improvement effect is high about especially. The addition of a fluid amelioration agent has 0.01 - 5% of the weight of the desirable range to the spherical inorganic particle which is abrasives, and its 0.1 - 4 % of the weight is more desirable especially. If the addition of a fluid amelioration agent does not have the enough addition effectiveness at less than 0.01 % of the weight and, on the other hand, exceeds 5 % of the weight, the addition effectiveness will be spoiled on the contrary.

[0025] In addition, it can face carrying out addition mixing of the fluid amelioration agent, the matter which gives the water repellence by which surface preparation was carried out to the spherical inorganic particle can be used as a binder, and a fluid amelioration agent can also be made to adhere to a spherical inorganic particle front face through this binder. In this case, by a fluid amelioration agent's achieving the function as

a cushioning material, and suppressing the repulsive force of the abrasives at the time of grinding, the side edge in septum formation of PDP is prevented, or the effectiveness of raising the scribe precision in solar-battery manufacture is acquired. Furthermore, the fluidity in a blasting machine and the dispersibility of the abrasives at the time of blasting are raised further, and it is effective in making the residual property of the abrasives to this workpiece top at the time of these blasting termination reduce moreover.

[0026] Moreover, when performing blasting, it responds to the grinding minimum flute width (in the case of shot blasting, it is the minimum shot blasting flute width) (micrometer) C to the particle diameter of these abrasives. The desirable maximum particle diameter exists. The abrasives of this invention the maximum particle diameter A of the spherical inorganic particle which constitutes abrasives (micrometer) -- relation with the grinding minimum flute width C (micrometer) -- setting -- desirable -- the following type (1) -- more -- desirable -- the following formula (5) -- a spherical inorganic particle is selected so that the following type (6) may be satisfied still more preferably.

[0027] Ten <=A<=0.8C (1)

Eleven <=A<=0.7C (5)

Twelve <=A<=0.6C (6)

[0028] That is, the grinding of the lower part of the part in which the probability for a bigger particle than the flute width which carries out grinding to exist became high when the maximum particle diameter in a spherical inorganic particle exceeded 0.8C, the big abrasives particle was caught in the slot by which grinding was carried out to some extent, consequently the particle was caught is barred, breakage of a septum is produced depending on the case, and there is an inclination which causes decline in process tolerance and productive efficiency. Moreover, when the maximum particle diameter of a spherical inorganic particle becomes smaller than 10 micrometers, it becomes extremely small, the grinding capacity of an abrasives particle piece declines, and the mean particle diameter of a spherical inorganic particle also has the inclination for abrasives with sufficient grinding effectiveness not to be obtained. That is, by considering as the above-mentioned configuration, breakage of a septum is prevented and the precision of a septum improves remarkably.

[0029] Moreover, the mean particle diameter of a spherical inorganic particle affects the working speed at the time of blasting, and the dispersibility of abrasives. these properties -- taking into consideration -- this invention -- the mean particle diameter B of a spherical inorganic particle (micrometer) -- relation with the minimum grinding flute width C (micrometer) -- setting -- desirable -- the following type (2) -- desirable -- the following formula (7) -- it selects so that the following type (8) may be satisfied still more preferably.

[0030] 0.02 C<=B<=0.5C (2)

0.04 C<=B<=0.4C (7)

0.05 C<=B<=0.3C (8)

[0031] That is, in a precise blasting grinding process, desirable mean particle diameter exists according to the grinding minimum flute width C like the scribe line of the septum formation and the solar battery using the sandblasting method of PDP. Although the mass per piece of an abrasives particle increases and the grinding force in the collision which is 1 time of a particle also increases when mean particle diameter exceeds 0.5C

consequently, there is an inclination for the level of significance which does damage to the electrode and substrate front face which were prepared on the substrate which consists of glass which is a workpiece pars basilaris ossis occipitalis to also become large. Moreover, when mean particle diameter is smaller than 0.02C, the inclination which decreases has the mass per piece of an abrasives particle, and the grinding force [in / it becomes small and / one collision of a particle]. Consequently, although the danger of doing damage to the electrode and substrate front face which were prepared on the substrate which consists of glass which is a workpiece pars basilaris ossis occipitalis in PDP is avoidable, polish effectiveness may fall remarkably. That is, polish effectiveness can be held even if the minimum processing flute width becomes small by considering as the above-mentioned configuration. Moreover, it can say that the same is said of scribe processing of a solar battery. In addition, the maximum particle diameter and mean particle diameter of a spherical inorganic particle are hardly different from the maximum particle diameter of the spherical inorganic particle which carried out surface treatment of the matter which gives water repellence, i.e., an abrasives particle, and mean particle diameter, and are substantially the same.

[0032] Blasting of the minimum processing flute width C in septum formation of PDP using the sandblasting method and the grinding process of the scribe line of a solar battery is mainly carried out in 50-1000 micrometers, and its this invention is also usually suitable for this range.

[0033] As described above, the abrasives of this invention which controlled the surface treatment particle which carried out surface treatment by the matter which gives water repellence or the abrasives which comes to add a fluid amelioration agent to this surface treatment spherical inorganic particle further, the maximum particle diameter [further as opposed to the grinding minimum flute width], mean particle diameter, etc. can be used suitable for removal of the oxide skin of the semi-conductor field etc. For example, although the polish approach which much more micro processing is called for and has been conventionally performed with wet is shifting to dry type for highly-minute-izing of the TFT panel, and a raise in a numerical aperture, the abrasives of this invention can be applied effective in this dry type polish approach, and effectiveness of precision is well good in the polish which needs energy with especially expensive metal, oxide film, etc.

[0034] Moreover, the abrasives of above-mentioned this invention are applicable as abrasives for septum formation of a PDP tooth-back substrate good [effectiveness] and accurate. It sets like the septum formation fault of PDP, and the septum is formed by the sandblasting method, the rib material layer which has blasting nature is prepared on a glass substrate, patterning is performed by the resin layer which has blasting-proof nature, and a septum is formed by carrying out blasting from the upper part.

[0035] Furthermore, the abrasives of above-mentioned this invention are applicable as abrasives for solar-battery scribe processing good [effectiveness] and accurate.

[0036] As mentioned above, since surface treatment of the abrasives of this invention is carried out by the matter which gives water repellence, they are useful as abrasives with high polish effectiveness and process tolerance by controlling the maximum particle diameter and mean particle diameter according to the grinding minimum flute width which prevents effectively troubles, such as adhesion in condensation of the abrasives resulting from moisture, union, and a ground object, for example, is made into the purpose on the occasion of the septum formation process of the PDP panel, scribe

processing of a solar battery, etc.
[0037] moreover, the workpiece not only by the condensation prevention effectiveness of the spherical inorganic particle fine particles by liquid bridge formation being acquired when the abrasives of this invention perform surface treatment with the matter which gives water repellence but a metal abrasive material etc. -- it rubs in and the prevention effectiveness is acquired. for example, when stainless steel powder etc. is used in the production process of a PDD back-in-panels side substrate, the septum which consists of low-melt point point lead glass of the white which is a ground object etc. is based on a metal abrasive material -- rubbing in -- it discolors, and such a trouble is prevented although the case where the brightness of PDP is reduced is generated. Furthermore, the effectiveness which raises the separation efficiency of the low melting glass and metal abrasives, such as stainless steel, using magnetism is acquired. The reuse of the low melting glass which is a ground object by this becomes possible, and it becomes possible to measure the manufacture cost reduction of PDP.
[0038]
[Example] Although an example and the example of a comparison are given and this invention is explained still more concretely hereafter, the range of this invention does not receive a limit at all by these. In addition, as a ground object, according to the following septum formation approach, the PDP back panel for an experiment was used, the injection pressure of abrasives and the injection weight per time amount were adjusted uniformly, the septum formation trial was performed, and the shape of front planarity and septum configuration of a glass base of a workpiece pars basilaris ossis occipitalis were observed.
[0039] septum formation approach: -- manufacture [of the PDP back panel for (A) experiment]: -- the electrode was formed on the soda lime glass substrate (an electrode surface is protected in a magnesium-oxide layer), and the grinding flute width (regularity, i.e., septum spacing, -- fixed) formed the septum pattern which is 100 micrometers by the mask material which applies a low-melting-glass paste by the coating machine on it, and has blasting-proof nature on the front face after desiccation.
[0040] (B) It blasts. : like the above, the manufactured PDP back panel for an experiment was used, and the grinding experiment by the various abrasives of the following example and the example of a comparison was conducted. Processing conditions were set up as follows, the septum formation time amount of various abrasives was measured, and a septum configuration and polish precision were observed.
injection nozzle aperture: -- 10mm abrasives injection-pressure: -- 3.0kg/cm2 (290kPa) abrasives injection-quantity: -- distance [to a 100 g/min panel]: -- 10cm [0041] As a ground object, the tooth-back base for a PDP trial was used, the injection pressure of a blasting machine and the injection weight per time amount of an abrasive material were adjusted uniformly, the septum formation trial was performed, and process tolerance was evaluated by observing the shape of front planarity and septum configuration of a glass base of a workpiece pars basilaris ossis occipitalis. Moreover, it evaluated also about the propriety of reboot nature. A presentation and evaluation result of spherical abrasives are shown in Table 1. In addition, the measuring method of the property of the abrasives particle in Table 1 and evaluation were performed by the following approach.
[0042] The maximum particle diameter of the inorganic particle fine particles which constitute abrasives, and mean particle diameter were measured using the Nikkiso Co.,

Ltd. micro truck FRA.
[0043] As evaluation of polish effectiveness, the (second) was measured for the cutting speed of each abrasives by this injection pressure.
[0044] The characteristic which shows a globular form computed the average of the value which chose 20 electron microscope photograph ****** particles, and measured them at random.
[0045] Using the electron microscope, process tolerance carried out visual observation of the shape of front planarity of the blemish of the groove bottom section of the PDP back panel after polish, a slot, or its side edge, and evaluated it by the following criteria.
Fitness: There is no blemish, the processing configuration of a slot is uniform and there is no side edge.
a little -- defect: -- and/or there are a little blemishes, the processing configuration of a slot is a little uneven, and the inclination of a side edge is seen a little.
Defect: And/or there are many blemishes, the processing configuration of a slot is uneven and the side edge has occurred.
Impossible: Septum formation by processing cannot be performed.
[0046] As matter which uses a glass bead with a mean particle diameter [example 1 / of 26 micrometers], and a maximum particle diameter of 53 micrometers, and gives this water repellence Stearin acid (TST: Miyoshi Oil & Fat Co., Ltd. make) is added 1% of the weight to the glass bead 100 weight section. Further as a fluid amelioration agent The white carbon (made in [chemistry incorporated company] star SHIRUS: Kami-shima) whose mean particle diameter is 0.03 micrometers was added 0.5% of the weight to the glass bead 100 weight section, heating mixing was carried out with the Henschel mixer, and abrasives were obtained.
[0047] By sandblasting processing which used these abrasives, although the septum of PDP was formed, it was able to be processed with a sufficient precision, without damaging a septum. Moreover, the blasting machine was stopped, and also about starting of the blasting machine after neglect, there is no ****** in a nozzle etc. and it has rebooted one whole day and night.
[0048] The glass bead with a mean particle diameter [example 2 / of 30 micrometers] and a maximum particle diameter of 53 micrometers was used, stearin acid (TST; Miyoshi Oil & Fat Co., Ltd. make) was added 0.5% of the weight to the glass bead 100 weight section as matter which gives this water repellence, further, the white carbon (made in [chemistry incorporated company] star SHIRUS: Kami-shima) whose mean particle diameter is 0.03 micrometers as a fluid amelioration agent was added 1% of the weight to the glass bead 100 weight section, heating mixing was carried out with the Henschel mixer, and abrasives were obtained.
[0049] It was able to be processed with a sufficient precision, without damaging a septum by sandblasting processing which used these abrasives, although septum formation of PDP was performed. moreover, a blasting machine is suspended -- making -- one whole day and night -- starting of the blasting machine after neglect -- also being related -- a nozzle etc. -- also getting it blocked -- there is nothing and it has rebooted smoothly.
[0050] The alundum with a mean particle diameter [example 3 / of 20 micrometers] and a maximum particle diameter of 44 micrometers was used, stearin acid (TST; Miyoshi Oil & Fat Co., Ltd. make) was added 2% of the weight to the alundum 100 weight section as matter which gives this water repellence, heating mixing was carried out with the

Henschel mixer, and abrasives were obtained.
[0051] It was able to be processed with a sufficient precision, without damaging a septum by sandblasting processing which used these abrasives, although septum formation of PDP was performed. moreover, a blasting machine is suspended -- making -- one whole day and night -- starting of the blasting machine after neglect -- also being related -- a nozzle etc. -- also getting it blocked -- there is nothing and it has restarted smoothly.
[0052] The Carborundum with a mean particle diameter [example 4 / of 15 micrometers] and a maximum particle diameter of 37 micrometers was used, stearin acid (TST: MIYOSHI oil incorporated company make) was added 3% of the weight to the Carborundum 100 weight section as matter which gives this water repellence, further, the white carbon (made in [chemistry incorporated company] star SHIRUS: Kami-shima) whose mean particle diameter is 0.03 micrometers as a fluid amelioration agent was added 0.3% of the weight to the Carborundum 100 weight section, heating mixing was carried out with the Henschel mixer, and abrasives were obtained.
[0053] By sandblasting processing which used these abrasives, without damaging a septum, when septum formation of PDP was performed, there is also no side edge and it was able to be processed with a sufficient precision. moreover, a blasting machine is suspended -- making -- one whole day and night -- starting of the blasting machine after neglect -- also being related -- a nozzle etc. -- also getting it blocked -- there is nothing and it has rebooted smoothly.
[0054] The glass bead with a mean particle diameter [example 5 / of 35 micrometers] and a maximum particle diameter of 74 micrometers was used. Stearin acid (TST: MIYOSHI oil incorporated company make) was added 0.1% of the weight to the glass bead 100 weight section as matter which gives this water repellence, further, the white carbon (made in [chemistry incorporated company] star SHIRUS: Kami-shima) whose mean particle diameter is 0.03 micrometers as a fluid amelioration agent was added 0.3% of the weight to the glass bead 100 weight section, heating mixing was carried out with the Henschel mixer, and abrasives were obtained.
[0055] By sandblasting processing which used these abrasives, without damaging a septum, when septum formation of PDP was performed, there is also no side edge and it was able to be processed with a sufficient precision. moreover, a blasting machine is suspended -- making -- one whole day and night -- starting of the blasting machine after neglect -- also being related -- a nozzle etc. -- also getting it blocked -- there is nothing and it has restarted smoothly.
[0056] The glass bead adjusted to example 6 mean particle diameter of 10 micrometers and the maximum particle diameter of 74 micrometers was used. Stearin acid (TST: MIYOSHI oil incorporated company make) was added 3% of the weight to the glass bead 100 weight section as matter which gives this water repellence, further, the white carbon (made in [chemistry incorporated company] star SHIRUS: Kami-shima) whose mean particle diameter is 0.03 micrometers as a fluid amelioration agent was added 2% of the weight to the glass bead 100 weight section, heating mixing was carried out with the Henschel mixer, and abrasives were obtained.
[0057] By sandblasting processing which used these abrasives, without damaging a septum, when septum formation of PDP was performed, there is also no side edge and it was able to be processed with a sufficient precision. moreover, a blasting machine is suspended -- making -- one whole day and night -- starting of the blasting machine after

neglect -- also being related -- a nozzle etc. -- also getting it blocked -- there is nothing and it has rebooted smoothly.
[0058] The stainless steel powder adjusted to example 7 mean particle diameter of 20 micrometers and the maximum particle diameter of 52 micrometers was used. Stearin acid (TST: MIYOSHI oil incorporated company make) was added 0.4% of the weight to the stainless steel powder 100 weight section as matter which gives this water repellence, heating mixing was carried out with the Henschel mixer, and abrasives were obtained.
[0059] By sandblasting processing which used this abrasive material, without damaging a septum, when septum formation of PDP was performed, there is also no side edge and it was able to be processed with a sufficient precision. Moreover, it rubs in, there is also no phenomenon and the effectiveness which raises the separation efficiency of the low melting glass using magnetism to a septum peculiar to metal abrasives and metal abrasives, such as stainless steel, was acquired. furthermore, a blasting machine is suspended -- making -- one whole day and night -- starting of the blasting machine after neglect -- also being related -- a nozzle etc. -- also getting it blocked -- there is nothing and it has rebooted smoothly.
[0060] An example 8 substantia-compacta limestone is roasted, digested and carbonated. The maximum particle diameter of 75 micrometers, Manufacture a whisker-like calcium carbonate with a mean particle diameter of 2 micrometers, and stearin acid (TST: Miyoshi Oil & Fat Co., Ltd. make) is added 1.3% of the weight to the whisker-like calcium-carbonate particle fine-particles 100 weight section which is abrasives to this. By making into a fluid amelioration agent fumed silica (Reolosil CP-102: Tokuyama Soda Co., Ltd. make) whose mean particle diameter is furthermore 0.05 micrometers, it added 2% of the weight to the whisker-like calcium-carbonate particle fine-particles 100 weight section, heating mixing was carried out with the Henschel mixer, and abrasives were obtained.
[0061] By sandblasting processing which used these abrasives, when septum formation of PDP was performed, the inclination of a side edge was seen, a part of septum was damaged, and the precision of a septum was a little poor. About the restart after stopping a blasting machine and leaving it one whole day and night, it was a little difficult.
[0062] The glass bead with a mean particle diameter [example of comparison 1 / of 60 micrometers] and a maximum particle diameter of 74 micrometers was used. As a fluid amelioration agent, the white carbon (made in [chemistry incorporated company] star SHIRUS: Kami-shima) whose mean particle diameter is 0.03 micrometers was added 0.3% of the weight to the glass bead 100 weight section, heating mixing was carried out with the Henschel mixer, and abrasives were obtained.
[0063] By sandblasting processing which used these abrasives, when septum formation of PDP is performed, the septum has collapsed. Moreover, condensation of abrasives was unable to occur and restart the inside of a blasting machine, and near a nozzle about the restart after stopping a blasting machine and leaving it one whole day and night.
[0064] The glass bead adjusted to example of comparison 2 mean particle diameter of 10 micrometers and the maximum particle diameter of 105 micrometers was used. As a fluid amelioration agent, the white carbon (made in [chemistry incorporated company] star SHIRUS: Kami-shima) whose mean particle diameter is 0.03 micrometers was added 2% of the weight to the glass bead 100 weight section, heating mixing was carried out with the Henschel mixer, and abrasives were obtained.

[0065] By sandblasting processing which used these abrasives, when septum formation of PDP was performed, the part where a part of septum collapses occurred. Moreover, condensation of abrasives was unable to occur and restart the inside of a blasting machine, and near a nozzle about the restart after stopping a blasting machine and leaving it one whole day and night.
[0066] The glass bead adjusted to example of comparison 3 mean particle diameter of 20 micrometers and the maximum particle diameter of 62 micrometers was used. The white carbon (made in [chemistry incorporated company] star SHIRUS: Kami-shima) whose mean particle diameter is 0.03 micrometers was added 2% of the weight to the glass bead 100 weight section as a fluid amelioration agent to this, it mixed with the Henschel mixer to it, and abrasives were obtained to it.
[0067] Although the septum has been formed by sandblasting processing which used these abrasives when septum formation of PDP was performed, the inclination of a side edge was seen. Moreover, condensation of abrasives was unable to occur and restart the inside of a blasting machine, and near a nozzle about the restart after stopping a blasting machine and leaving it one whole day and night.
[0068] The glass bead adjusted to example of comparison 4 mean particle diameter of 15 micrometers and the maximum particle diameter of 44 micrometers was used as abrasives.
[0069] By sandblasting processing which used these abrasives, when septum formation of PDP was performed, the inclination of a strong side edge was seen and the septum was not able to be formed with a sufficient precision. Moreover, condensation of abrasives was unable to occur and restart the inside of a blasting machine, and near a nozzle about the restart after stopping a blasting machine and leaving it one whole day and night.
[0070] The stainless steel powder adjusted to example of comparison 5 mean particle diameter of 25 micrometers and the maximum particle diameter of 150 micrometers was used as abrasives.
[0071] By sandblasting processing which used these abrasives, when septum formation of PDP was performed, the inclination of a side edge was seen, a part of septum was damaged, and the septum was not able to be formed with a sufficient precision. moreover, the septum which is the fault of metal abrasives -- it rubbed in and a phenomenon and adhesion occurred. Reuse of low melting glass of the separation efficiency of the low melting glass and metal abrasives, such as stainless steel, which furthermore used magnetism was not completed bad. About the restart after stopping a blasting machine and leaving it one whole day and night, it was a little difficult.
[0072]
[Table 1]

例	球状無機粒子	球水性付与物質 (%)	流動性改良剤 (%)	B 平均粒子径(μm)	A 最大粒子径(μm)	球形指数 (%)	再起動性	加工精度
実施例1	ガラスビーズ	1	0.5	26	53	99	可能	良好
実施例2	ガラスビーズ	0.5	1	30	53	99	可能	良好
実施例3	アランダム	2	0	20	44	96	可能	良好
実施例4	カーボランダム	3	0.3	15	37	97	可能	良好
実施例5	ガラスビーズ	0.1	0.3	35	74	98	可能	良好
実施例6	ガラスビーズ	3	2	10	74	99	可能	良好
実施例7	ステンレス	0.4	0	20	52	58	可能	良好
実施例8	炭酸カルシウム	1.3	2	2	75	32	やや困難	やや不良
比較例1	ガラスビーズ	0	0.3	60	74	98	不可	不能
比較例2	ガラスビーズ	0	2	10	105	98	不可	不良
比較例3	ガラスビーズ	0	2	20	62	98	不可	やや不良
比較例4	ガラスビーズ	0	0	15	44	98	不可	不良
比較例5	ステンレス	0	0	25	150	55	やや困難	不良

A:球状無機粒子の最大粒子径(μm)
B:球状無機粒子の平均粒子径(μm)
C:研削最小溝幅(μm)
(註)
10≦A≦80 (μm)
3≦B≦50 (μm)
C=1000 (μm)

[0073]
[Effect of the Invention] As mentioned above, since surface treatment of the abrasives of this invention is carried out by the matter which gives water repellence, they are useful as abrasives with high polish effectiveness and process tolerance by controlling the maximum particle diameter and mean particle diameter according to the grinding minimum flute width which prevents effectively troubles, such as adhesion in condensation of the abrasives resulting from moisture, union, and a ground object, for example, is made into the purpose on the occasion of the septum formation process of the PDP panel, scribe processing of a solar battery, etc.

TECHNICAL FIELD

[Field of the Invention] This invention relates to abrasives excellent in polish effectiveness and process tolerance while preventing effectively troubles, such as adhesion in condensation of the abrasives resulting from moisture, union, and a ground object, in more detail about the abrasives using a spherical inorganic particle used for dry-type precise sandblasting processing.

PRIOR ART

[Description of the Prior Art] Blasting is the industrial technique used widely, in order to inject an abrasives particle on the surface of a workpiece at high speed, to carry out grinding of the workpiece front face, or to remove the dirt adhering to a front face, or to give impulse force to a workpiece front face and to improve the property of the front face. Recently, it is increasingly used for processing of the detailed field this technique of whose is several 10 micrometers which was not considered conventionally. For example, the sandblasting method is taken up as leading technique by the approach of forming the septum of a plasma display panel (it is hereafter described as PDP), and, partly, it is in a practical use phase. A low-melting-glass layer with a thickness of 1mm or less which has blasting nature is formed on the glass substrate with which the electrode was prepared, and grinding of a detailed slot called width of face of 50-1000 micrometers is carried out to this low-melting-glass layer by Mr. Fukashi of the electrode on a glass substrate or a glass substrate. In this case, by injecting and carrying out blasting of the abrasives to the front-face side of a masking tape, a flute width carries out grinding of the low-melting-glass layer, and forms a septum. This diaphragm is calcinated at a next process and serves as an inorganic glass septum. It is referred to as PDP for a fluorescent substance etc. to be installed in the space between this septum.

[0003] moreover, the conductor which set two or more solar battery elements to the manufacture of a solar battery which carries out series connection electrically, sprayed the particle fine particles which are abrasives as a gas stream on each electric conduction film, such as transparence electric conduction film in which opening was formed by the predetermined pattern as an approach of separating and accumulating for every solar battery element, a photo-electric-conversion layer, and a rear-face electrode, and was exposed to opening -- the sandblasting method for carrying out the scribe of the film is tried. The sandblasting method is tried by the detailed grinding for similarly obtaining electric connection of the Bahia hall processing, oxide skin removal of a semi-conductor circuit element, etc. for the multilayer-interconnection plate by which high density assembly was carried out.

[0004] By the sandblasting method used for removal of the oxide film of electrodes, such as septum formation of the above-mentioned PDP tooth-back substrate, or a solar battery, or a semi-conductor, with grinding waste (the paste material or coat formation object by which grinding was carried out), the injected abrasives are eliminated from a grinding part, acquire separation processes, such as a screen, are collected, and are primarily stored in a reservoir tank etc., and a reuse is carried out to blasting. As an abrasives particle, according to the purpose, the glass bead of various presentations, an alundum, corundum, a ceramic bead, stainless steel, copper, etc. are proposed, and it is used actually. Such particle shape is made desirable [the configuration near a globular form or a globular form].

[0005] It is that removal of a big and rough particle is easy in the manufacture process of abrasives as an advantage for which the particle of the configuration near a globular form or a globular form as abrasives is used, and there is no adhesion to the workpiece in blasting, a fluidity is good, and there is little wear of abrasives.

[0006] however, ** et al. and a mean diameter -- several 10 micrometers - several micrometers the conveyance circuit of the abrasives from service tanks once a fluidity was not good or suspended equipment, even if the configuration of a metaphor abrasives particle was very close to the real ball when inorganic abrasives were used for the

sandblasting method, when it is going to reboot after a while to a nozzle -- on the way -- the case where come out and it stops flowing at all happens. In such a case, if an impact is added to a choked part, abrasives may start a flow, but after carrying out disassembling equipment etc. and eliminating all the abrasives in equipment, in many cases, a part or all will be changed to new abrasives, they will reboot to them, and serve as remarkable trouble at workability and productivity. Especially, it has two or more nozzles (abrasives injection part), and great time amount and a great effort are needed for exchange of abrasives with the large-sized blasting machine incorporating the recovery system of abrasives.

[0007] Since lock out of abrasives takes place also with the equipment with which the policy of destaticization was given, this cause is presumed to depend liquid bridge formation on starting between each contact section of an abrasives particle, or some detailed grinding waste and abrasives particles considering maldistribution with moisture [minute amount / during blasting or a halt] with time as a lifting and a result.

[0008] That is, in sandblasting processing by the blasting machine, abrasives are injected at high pressure and a high speed from an injection nozzle, in a nozzle point, the low-temperature part by injection arises and the waterdrop by the temperature gradient occurs in a nozzle point. And the case which abrasives condense with the moisture after a blasting machine halt and in this machine is often generated. Moreover, especially, in a large-sized sandblast cleaning machine, in order to reboot the abrasives in a nozzle point and a machine by condensation of the abrasives in a machine, and solidification, it must once discharge out of a system. When a machine exists in a clean room, such activities not only reduce productive efficiency, but will reach to an extreme of difficulty. Moreover, the moisture generated in the injection nozzle point of a blasting machine acts as a binder of abrasives, and the case which the phenomenon in which abrasives adhere to a grinding-ed object front face generates is also reported.

[0009] On the other hand, it compares with a flute width like septum formation of PDP. In grinding with a deep channel depth If grinding progresses to some extent and a slot is ****(ed) although an abrasives particle is a configuration near a globular form or a globular form therefore In order that an abrasives particle may collide with a groove face side on the contrary in the groove bottom section of a ground object, there is also a problem that the configuration of a septum (or slot) cannot become fixed easily (a side edge becomes large). Although it is considerably improvable if the injection pressure of abrasives is weakened, scouring velocity will be sacrificed for this problem as a result.

[0010] Furthermore, the present condition is that qualitative selection is performed about the magnitude of an abrasives particle from detailed processing being difficult since the curvature of an abrasives particle is large etc. although a bigger abrasives particle has larger scouring velocity since mass is large. However, abrasives should have the grain-size configuration whose process tolerance can enlarge working speed highly according to the configuration of a workpiece.

[0011] As mentioned above, by micro processing by the sandblasting method, abrasives with sufficient working efficiency are called for with the fluidity of the abrasives which become an important factor about working efficiency, the fluid reservation especially at the time of a reboot, process tolerance, and the dissolution of the side edge which influences both working efficiency and high degree of accuracy.

EFFECT OF THE INVENTION

[Effect of the Invention] As mentioned above, since surface treatment of the abrasives of this invention is carried out by the matter which gives water repellence, they are useful as abrasives with high polish effectiveness and process tolerance by controlling the maximum particle diameter and mean particle diameter according to the grinding minimum flute width which prevents effectively troubles, such as adhesion in condensation of the abrasives resulting from moisture, union, and a ground object, for example, is made into the purpose on the occasion of the septum formation process of the PDP panel, scribe processing of a solar battery, etc.

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] This invention is what was made in view of the above-mentioned actual condition. The technical problem Cancel the above-mentioned trouble and it is especially used for removal of the oxide skin of semi-conductors, such as grinding of septum formation processing of PDP, and the scribe line of a solar battery, etc. suitably in dry type. While precision can improve grinding efficiently, without spoiling the description of a workpiece pars-basilaris-ossis-occipitalis front face, it is in offering the abrasives which can reboot also after preventing condensation of the abrasives particle resulting from moisture, for example, suspending the blasting machine between one whole day and night at least.

MEANS

[Means for Solving the Problem] this invention persons by carrying out surface treatment of the matter which gives water repellence to a spherical inorganic particle, as a result of inquiring wholeheartedly The condensation by the liquid bridge formation resulting from the moisture of an abrasives particle is prevented. For example, the abrasives which can reboot also after suspending a blasting machine above one whole day and night can be offered. A fluid improvement furthermore, by controlling a scale, the grinding minimum flute width (micrometer), the configuration of abrasives, the maximum particle diameter, mean particle diameter, etc. by adding the particle which consists of 1/10 or less diameter of particle diameter to an abrasives particle Ultra-precision machining reached a header and this invention in usable abrasives in the required semi-conductor field etc.

[0014] That is, the abrasives for dry type blasting characterized by this invention coming to carry out surface preparation of the matter which gives water repellence to a spherical inorganic particle are made into the contents (claim 1). In addition, in this invention, vocabulary called grinding is used as vocabulary which also includes shot blasting besides grinding.

[0015] They are the abrasives according to claim 1 which come to add the fluid amelioration agent which consists of 1/10 or less mean particle diameter of the mean particle diameter of a spherical inorganic particle 0.01 to 5% of the weight to a spherical

inorganic particle as a desirable mode (claim 2).
[0016] As a desirable mode, spherical inorganic particles are the abrasives according to claim 1 or 2 with which are satisfied of following type (1) - (3) (claim 3).
Ten <=A<=0.8C (1)
0.02 C<=B<=0.5C (2)
50<=C<=1000 (3)
However, A: The maximum particle diameter of abrasives (micrometer)
B: Mean particle diameter of abrasives (micrometer)
C: Grinding or the minimum flute width which carries out shot blasting (micrometer)
[0017] As a desirable mode, they are abrasives given in any 1 term of claims 1-3 used for removal of the oxide skin of a semi-conductor (claim 4).
[0018] As a desirable mode, they are abrasives given in any 1 term of claims 1-3 used for formation of the rib material to the tooth-back substrate top of PDP (claim 5).
[0019] As a desirable mode, they are abrasives given in any 1 term of claims 1-3 used for formation of the scribe line for series connections of a solar battery element (claim 6).
[0020]
[The gestalt of invention implementation] Hereafter, this invention is explained to a detail. This invention can be characterized by being the abrasives for dry type blasting characterized by coming to carry out surface preparation of the matter which gives water repellence to a spherical inorganic particle, can prevent effectively condensation of the abrasives by the liquid bridge formation between particles which originates in moisture by this, union, or adhesion in the workpiece of abrasives, and can raise grinding effectiveness and grinding precision sharply.
[0021] As a spherical inorganic particle used for this invention, spherical inorganic particle fine particles, such as a glass bead, an alundum, corundum, a ceramic bead, stainless steel, and copper, are mentioned, for example. In this invention, the rate of area to the circumscribed circle of particle projected area says 80% or more of case more preferably 50% or more so that it may be defined as spherical by the following formula (4).

$$\text{外接円に対する面積率（%）} = \frac{\text{粒子の投影面積}}{\text{粒子投影面積の外接円の面積}} \times 100 \quad (4)$$

[0022] It can use without being limited especially if it is the matter which gives water repellence as matter which gives the water repellence used for this invention. When it illustrates concretely, oleic acid, a lauric acid, a myristic acid, isotridecyl myristate, AMAIDO and bis-AMAIDO of the fatty-acid; aforementioned fatty acid, such as a palmitic acid, behenic acid, stearin acid, and isostearic acid; The higher-fatty-acid ester of higher alcohol, such as stearyl alcohol, or branching higher-alcohol; monohydric alcohol, Fatty-acid-ester system lubricant, such as higher-fatty-acid ester of polyhydric alcohol, very long-chain montan wax type ester, or its partial hydrolysate; Barium stearate, Calcium stearate, aluminum stearate, zinc stearate, Metallic soap system lubricant, such as magnesium stearate or its complex; A 16 or more C liquid paraffin, A micro crystallin wax, native paraffin, synthetic paraffin, Aliphatic hydrocarbon system lubricant, such as polyolefine waxes and these partial oxidation objects, a fluoride, and a chloride; A

silicone oil, Soybean oil, palm oil, palm kernel oil, the linseed oil, rapeseed oil, cotton seed oil, tung oil, Oils;HLB, such as castor oil, beef tallow, squalane, lanolin, and hardened oil, nine or less surfactant, For example, carboxylate, such as N-acylamino acid chloride, alkyl ether carboxylate, and acyl peptide; An alkyl sulfonate, Alkylbenzene and alkylnaphthalenesulfonate, sulfone succinate, Sulfonates, such as alpha-olefin sulfonate and N-acyl sulfonate; Sulfated oil, Alkyl sulfate, alkyl ether sulfate, an alkyl allyl compound ethereal sulfate salt, Sulfate salts, such as an alkylamide sulfate; Alkyl phosphate, alkyl ether phosphate, Anionic surfactants, such as phosphate, such as alkyl allyl compound ether phosphate; Alkylamine salt, Aliphatic series quarternary ammonium salt, a benzalkonium salt, benzethonium chloride, Cationic surfactants, such as pyridinium salt and imidazolinium salt; Carboxy betaine, Amphoteric surface active agents, such as aminocarboxylate, imidazolinium betaine, and lecithin; Polyoxyethylene alkyl ether, The ether 2nd class alcoholic [of a polyoxyethylene], polyoxyethylene alkyl phenyl ether, The polyoxyethylene sterol ether, a polyoxyethylene lanolin derivative, The ethylene oxide derivative of an alkylphenol formalin condensate, a polyoxyethylene polyoxypropylene blockpolymer, Polyoxyethylene polyoxypropylene alkyl ether, polyoxyethylene glycerine fatty acid ester, Polyoxyethylene castor oil and hardening castor oil, polyoxyethylene sorbitan fatty acid ester, Polyoxyethylene sorbitol fatty acid ester, polyethylene glycol fatty acid ester, A fatty-acid monoglyceride, polyglyceryl fatty acid ester, polyglyceryl fatty acid ester, A sorbitan fatty acid ester, fatty acid alkanolamide, a polyoxyethylene fatty-acid-ester amide, System-of-reaction surfactants, such as the nonionic surface active agent; fluorochemical surfactant; polyoxyethylene ARIRUGURISHIJIRU nonylphenyl ether, such as polyoxyethylene alkylamine and an alkylamine oxide; Gamma-chloropropyltrimetoxysilane, Vinyltriethoxysilane, vinyltrimetoxysilane, a vinyl tris (beta-methoxyethoxy) silane, Gamma-methacryloxpropyl trimethoxy silane, beta-(3, 4-epoxycyclohexyl) ethyltrimethoxysilane, Gamma-glycidoxypropyltrimetoxysilane, gamma-mercapto propyltrimethoxysilane, gamma-aminopropyl triethoxysilane, N-beta-(aminoethyl)-gamma-aminopropyl trimethoxysilane, Silane coupling agents, such as gamma-YUREIDO propyl TORIECHIKISHI silane; Isopropylisostearoyl titanate, Isopropyl tree n-dodecylbenzene sulfonyl titanate, isopropyl tris (dioctyl PIROHOSU fight) titanate, tetra-isopropyl bis(JITORIDESHIRUFOSU fight) titanate, Tetrapod (2 and 2-diaryl oxymethyl-1-butyl) bis(G tridecyl) FOSU fight titanate, Titanium coupling agents, such as bis(dioctyl pyrophosphate) ethylene titanate and isopropanal PIRUTORI (N-aminoethyl-aminoethyl) titanate, are mentioned, and these are independent, or they are combined two or more sorts and used. Cheap stearin acid is desirable especially.

[0023] The amount of surface treatment of the matter which gives water repellence has 0.01 - 5% of the weight of the desirable range to a spherical inorganic particle, and its 0.1 - 4 % of the weight is more desirable especially. Even if the amount of surface treatment of the matter which gives water repellence does not have the enough surface treatment effectiveness at less than 0.01 % of the weight and, on the other hand, exceeds 5 % of the weight, it is not not only economical, but the surface treatment effectiveness may not improve but it may spoil the physical properties of a ground object on the contrary.

[0024] By carrying out addition mixing of the fluid amelioration agent which becomes the above-mentioned surface treatment particle from 1/10 or less mean particle diameter of the mean particle diameter of a spherical inorganic particle, the abrasives of this

invention raise further the fluidity in a blasting machine, and the dispersibility of the abrasives at the time of blasting, and it becomes possible to make the residual property to the workpiece at the time of blasting termination reduce further of them. If a fluid amelioration agent is illustrated concretely, the end of superfines, such as talc, a silicic anhydride, a bentonite, a kaolin, a magnesium oxide, a magnesium carbonate, a magnesium silicate, a zinc oxide, a magnesium hydroxide, colloidal silica, diatomaceous earth, magnesium stearate, fused silica powder, fumed silica, a silica, cornstarch, starch, and a calcium silicate, will be mentioned, and these are independent, or they will be combined two or more sorts and will be used. A silicic anhydride and colloidal silica are desirable at the point that an improvement effect is high about especially. The addition of a fluid amelioration agent has 0.01 - 5% of the weight of the desirable range to the spherical inorganic particle which is abrasives, and its 0.1 - 4 % of the weight is more desirable especially. If the addition of a fluid amelioration agent does not have the enough addition effectiveness at less than 0.01 % of the weight and, on the other hand, exceeds 5 % of the weight, the addition effectiveness will be spoiled on the contrary.
[0025] In addition, it can face carrying out addition mixing of the fluid amelioration agent, the matter which gives the water repellence by which surface preparation was carried out to the spherical inorganic particle can be used as a binder, and a fluid amelioration agent can also be made to adhere to a spherical inorganic particle front face through this binder. In this case, by a fluid amelioration agent's achieving the function as a cushioning material, and suppressing the repulsive force of the abrasives at the time of grinding, the side edge in septum formation of PDP is prevented, or the effectiveness of raising the scribe precision in solar-battery manufacture is acquired. Furthermore, the fluidity in a blasting machine and the dispersibility of the abrasives at the time of blasting are raised further, and it is effective in making the residual property of the abrasives to this workpiece top at the time of these blasting termination reduce moreover.
[0026] Moreover, when performing blasting, it responds to the grinding minimum flute width (in the case of shot blasting, it is the minimum shot blasting flute width) (micrometer) C to the particle diameter of these abrasives. The desirable maximum particle diameter exists. The abrasives of this invention the maximum particle diameter A of the spherical inorganic particle which constitutes abrasives (micrometer) -- relation with the grinding minimum flute width C (micrometer) -- setting -- desirable -- the following type (1) -- more -- desirable -- the following formula (5) -- a spherical inorganic particle is selected so that the following type (6) may be satisfied still more preferably.
[0027] Ten <=A<=0.8C (1)
Eleven <=A<=0.7C (5)
Twelve <=A<=0.6C (6)
[0028] That is, the grinding of the lower part of the part in which the probability for a bigger particle than the flute width which carries out grinding to exist became high when the maximum particle diameter in a spherical inorganic particle exceeded 0.8C, the big abrasives particle was caught in the slot by which grinding was carried out to some extent, consequently the particle was caught is barred, breakage of a septum is produced depending on the case, and there is an inclination which causes decline in process tolerance and productive efficiency. Moreover, when the maximum particle diameter of a spherical inorganic particle becomes smaller than 10 micrometers, it becomes extremely

small, the grinding capacity of an abrasives particle piece declines, and the mean particle diameter of a spherical inorganic particle also has the inclination for abrasives with sufficient grinding effectiveness not to be obtained. That is, by considering as the above-mentioned configuration, breakage of a septum is prevented and the precision of a septum improves remarkably.

[0029] Moreover, the mean particle diameter of a spherical inorganic particle affects the working speed at the time of blasting, and the dispersibility of abrasives. these properties -- taking into consideration -- this invention -- the mean particle diameter B of a spherical inorganic particle (micrometer) -- relation with the minimum grinding flute width C (micrometer) -- setting -- desirable -- the following type (2) -- desirable -- the following formula (7) -- it selects so that the following type (8) may be satisfied still more preferably.

[0030] $0.02\ C<=B<=0.5C$ (2)

$0.04\ C<=B<=0.4C$ (7)

$0.05\ C<=B<=0.3C$ (8)

[0031] That is, in a precise blasting grinding process, desirable mean particle diameter exists according to the grinding minimum flute width C like the scribe line of the septum formation and the solar battery using the sandblasting method of PDP. Although the mass per piece of an abrasives particle increases and the grinding force in the collision which is 1 time of a particle also increases when mean particle diameter exceeds 0.5C consequently, there is an inclination for the level of significance which does damage to the electrode and substrate front face which were prepared on the substrate which consists of glass which is a workpiece pars basilaris ossis occipitalis to also become large. Moreover, when mean particle diameter is smaller than 0.02C, the inclination which decreases has the mass per piece of an abrasives particle, and the grinding force [in / it becomes small and / one collision of a particle]. Consequently, although the danger of doing damage to the electrode and substrate front face which were prepared on the substrate which consists of glass which is a workpiece pars basilaris ossis occipitalis in PDP is avoidable, polish effectiveness may fall remarkably. That is, polish effectiveness can be held even if the minimum processing flute width becomes small by considering as the above-mentioned configuration. Moreover, it can say that the same is said of scribe processing of a solar battery. In addition, the maximum particle diameter and mean particle diameter of a spherical inorganic particle are hardly different from the maximum particle diameter of the spherical inorganic particle which carried out surface treatment of the matter which gives water repellence, i.e., an abrasives particle, and mean particle diameter, and are substantially the same.

[0032] Blasting of the minimum processing flute width C in septum formation of PDP using the sandblasting method and the grinding process of the scribe line of a solar battery is mainly carried out in 50-1000 micrometers, and its this invention is also usually suitable for this range.

[0033] As described above, the abrasives of this invention which controlled the surface treatment particle which carried out surface treatment by the matter which gives water repellence or the abrasives which comes to add a fluid amelioration agent to this surface treatment spherical inorganic particle further, the maximum particle diameter [further as opposed to the grinding minimum flute width], mean particle diameter, etc. can be used suitable for removal of the oxide skin of the semi-conductor field etc. For example,

although the polish approach which much more micro processing is called for and has been conventionally performed with wet is shifting to dry type for highly-minute-izing of the TFT panel, and a raise in a numerical aperture, the abrasives of this invention can be applied effective in this dry type polish approach, and effectiveness of precision is well good in the polish which needs energy with especially expensive metal, oxide film, etc.
[0034] Moreover, the abrasives of above-mentioned this invention are applicable as abrasives for septum formation of a PDP tooth-back substrate good [effectiveness] and accurate. It sets like the septum formation fault of PDP, and the septum is formed by the sandblasting method, the rib material layer which has blasting nature is prepared on a glass substrate, patterning is performed by the resin layer which has blasting-proof nature, and a septum is formed by carrying out blasting from the upper part.
[0035] Furthermore, the abrasives of above-mentioned this invention are applicable as abrasives for solar-battery scribe processing good [effectiveness] and accurate.
[0036] As mentioned above, since surface treatment of the abrasives of this invention is carried out by the matter which gives water repellence, they are useful as abrasives with high polish effectiveness and process tolerance by controlling the maximum particle diameter and mean particle diameter according to the grinding minimum flute width which prevents effectively troubles, such as adhesion in condensation of the abrasives resulting from moisture, union, and a ground object, for example, is made into the purpose on the occasion of the septum formation process of the PDP panel, scribe processing of a solar battery, etc.
[0037] moreover, the workpiece not only by the condensation prevention effectiveness of the spherical inorganic particle fine particles by liquid bridge formation being acquired when the abrasives of this invention perform surface treatment with the matter which gives water repellence but a metal abrasive material etc. -- it rubs in and the prevention effectiveness is acquired. for example, when stainless steel powder etc. is used in the production process of a PDD back-in-panels side substrate, the septum which consists of low-melt point point lead glass of the white which is a ground object etc. is based on a metal abrasive material -- rubbing in -- it discolors, and such a trouble is prevented although the case where the brightness of PDP is reduced is generated. Furthermore, the effectiveness which raises the separation efficiency of the low melting glass and metal abrasives, such as stainless steel, using magnetism is acquired. The reuse of the low melting glass which is a ground object by this becomes possible, and it becomes possible to measure the manufacture cost reduction of PDP.

EXAMPLE

[Example] Although an example and the example of a comparison are given and this invention is explained still more concretely hereafter, the range of this invention does not receive a limit at all by these. In addition, as a ground object, according to the following septum formation approach, the PDP back panel for an experiment was used, the injection pressure of abrasives and the injection weight per time amount were adjusted uniformly, the septum formation trial was performed, and the shape of front planarity and septum configuration of a glass base of a workpiece pars basilaris ossis occipitalis were observed.

[0039] septum formation approach: -- manufacture [of the PDP back panel for (A) experiment]: -- the electrode was formed on the soda lime glass substrate (an electrode surface is protected in a magnesium-oxide layer), and the grinding flute width (regularity, i.e., septum spacing, -- fixed) formed the septum pattern which is 100 micrometers by the mask material which applies a low-melting-glass paste by the coating machine on it, and has blasting-proof nature on the front face after desiccation.
[0040] (B) It blasts. : like the above, the manufactured PDP back panel for an experiment was used, and the grinding experiment by the various abrasives of the following example and the example of a comparison was conducted. Processing conditions were set up as follows, the septum formation time amount of various abrasives was measured, and a septum configuration and polish precision were observed.
injection nozzle aperture: -- 10mm abrasives injection-pressure: -- 3.0kg/cm2 (290kPa) abrasives injection-quantity: -- distance [to a 100 g/min panel]: -- 10cm [0041] As a ground object, the tooth-back base for a PDP trial was used, the injection pressure of a blasting machine and the injection weight per time amount of an abrasive material were adjusted uniformly, the septum formation trial was performed, and process tolerance was evaluated by observing the shape of front planarity and septum configuration of a glass base of a workpiece pars basilaris ossis occipitalis. Moreover, it evaluated also about the propriety of reboot nature. A presentation and evaluation result of spherical abrasives are shown in Table 1. In addition, the measuring method of the property of the abrasives particle in Table 1 and evaluation were performed by the following approach.
[0042] The maximum particle diameter of the inorganic particle fine particles which constitute abrasives, and mean particle diameter were measured using the Nikkiso Co., Ltd. micro truck FRA.
[0043] As evaluation of polish effectiveness, the (second) was measured for the cutting speed of each abrasives by this injection pressure.
[0044] The characteristic which shows a globular form computed the average of the value which chose 20 electron microscope photograph ****** particles, and measured them at random.
[0045] Using the electron microscope, process tolerance carried out visual observation of the shape of front planarity of the blemish of the groove bottom section of the PDP back panel after polish, a slot, or its side edge, and evaluated it by the following criteria.
Fitness: There is no blemish, the processing configuration of a slot is uniform and there is no side edge.
a little -- defect: -- and/or there are a little blemishes, the processing configuration of a slot is a little uneven, and the inclination of a side edge is seen a little.
Defect: And/or there are many blemishes, the processing configuration of a slot is uneven and the side edge has occurred.
Impossible: Septum formation by processing cannot be performed.
[0046] As matter which uses a glass bead with a mean particle diameter [example 1 / of 26 micrometers], and a maximum particle diameter of 53 micrometers, and gives this water repellence Stearin acid (TST: Miyoshi Oil & Fat Co., Ltd. make) is added 1% of the weight to the glass bead 100 weight section. Further as a fluid amelioration agent The white carbon (made in [chemistry incorporated company] star SHIRUS: Kami-shima) whose mean particle diameter is 0.03 micrometers was added 0.5% of the weight to the glass bead 100 weight section, heating mixing was carried out with the Henschel mixer,

and abrasives were obtained.
[0047] By sandblasting processing which used these abrasives, although the septum of PDP was formed, it was able to be processed with a sufficient precision, without damaging a septum. Moreover, the blasting machine was stopped, and also about starting of the blasting machine after neglect, there is no ****** in a nozzle etc. and it has rebooted one whole day and night.
[0048] The glass bead with a mean particle diameter [example 2 / of 30 micrometers] and a maximum particle diameter of 53 micrometers was used, stearin acid (TST; Miyoshi Oil & Fat Co., Ltd. make) was added 0.5% of the weight to the glass bead 100 weight section as matter which gives this water repellence, further, the white carbon (made in [chemistry incorporated company] star SHIRUS: Kami-shima) whose mean particle diameter is 0.03 micrometers as a fluid amelioration agent was added 1% of the weight to the glass bead 100 weight section, heating mixing was carried out with the Henschel mixer, and abrasives were obtained.
[0049] It was able to be processed with a sufficient precision, without damaging a septum by sandblasting processing which used these abrasives, although septum formation of PDP was performed. moreover, a blasting machine is suspended -- making -- one whole day and night -- starting of the blasting machine after neglect -- also being related -- a nozzle etc. -- also getting it blocked -- there is nothing and it has rebooted smoothly.
[0050] The alundum with a mean particle diameter [example 3 / of 20 micrometers] and a maximum particle diameter of 44 micrometers was used, stearin acid (TST; Miyoshi Oil & Fat Co., Ltd. make) was added 2% of the weight to the alundum 100 weight section as matter which gives this water repellence, heating mixing was carried out with the Henschel mixer, and abrasives were obtained.
[0051] It was able to be processed with a sufficient precision, without damaging a septum by sandblasting processing which used these abrasives, although septum formation of PDP was performed. moreover, a blasting machine is suspended -- making -- one whole day and night -- starting of the blasting machine after neglect -- also being related -- a nozzle etc. -- also getting it blocked -- there is nothing and it has restarted smoothly.
[0052] The Carborundum with a mean particle diameter [example 4 / of 15 micrometers] and a maximum particle diameter of 37 micrometers was used, stearin acid (TST: MIYOSHI oil incorporated company make) was added 3% of the weight to the Carborundum 100 weight section as matter which gives this water repellence, further, the white carbon (made in [chemistry incorporated company] star SHIRUS: Kami-shima) whose mean particle diameter is 0.03 micrometers as a fluid amelioration agent was added 0.3% of the weight to the Carborundum 100 weight section, heating mixing was carried out with the Henschel mixer, and abrasives were obtained.
[0053] By sandblasting processing which used these abrasives, without damaging a septum, when septum formation of PDP was performed, there is also no side edge and it was able to be processed with a sufficient precision. moreover, a blasting machine is suspended -- making -- one whole day and night -- starting of the blasting machine after neglect -- also being related -- a nozzle etc. -- also getting it blocked -- there is nothing and it has rebooted smoothly.
[0054] The glass bead with a mean particle diameter [example 5 / of 35 micrometers] and a maximum particle diameter of 74 micrometers was used. Stearin acid (TST: MIYOSHI oil incorporated company make) was added 0.1% of the weight to the glass

bead 100 weight section as matter which gives this water repellence, further, the white carbon (made in [chemistry incorporated company] star SHIRUS: Kami-shima) whose mean particle diameter is 0.03 micrometers as a fluid amelioration agent was added 0.3% of the weight to the glass bead 100 weight section, heating mixing was carried out with the Henschel mixer, and abrasives were obtained.

[0055] By sandblasting processing which used these abrasives, without damaging a septum, when septum formation of PDP was performed, there is also no side edge and it was able to be processed with a sufficient precision. moreover, a blasting machine is suspended -- making -- one whole day and night -- starting of the blasting machine after neglect -- also being related -- a nozzle etc. -- also getting it blocked -- there is nothing and it has restarted smoothly.

[0056] The glass bead adjusted to example 6 mean particle diameter of 10 micrometers and the maximum particle diameter of 74 micrometers was used. Stearin acid (TST: MIYOSHI oil incorporated company make) was added 3% of the weight to the glass bead 100 weight section as matter which gives this water repellence, further, the white carbon (made in [chemistry incorporated company] star SHIRUS: Kami-shima) whose mean particle diameter is 0.03 micrometers as a fluid amelioration agent was added 2% of the weight to the glass bead 100 weight section, heating mixing was carried out with the Henschel mixer, and abrasives were obtained.

[0057] By sandblasting processing which used these abrasives, without damaging a septum, when septum formation of PDP was performed, there is also no side edge and it was able to be processed with a sufficient precision. moreover, a blasting machine is suspended -- making -- one whole day and night -- starting of the blasting machine after neglect -- also being related -- a nozzle etc. -- also getting it blocked -- there is nothing and it has rebooted smoothly.

[0058] The stainless steel powder adjusted to example 7 mean particle diameter of 20 micrometers and the maximum particle diameter of 52 micrometers was used. Stearin acid (TST: MIYOSHI oil incorporated company make) was added 0.4% of the weight to the stainless steel powder 100 weight section as matter which gives this water repellence, heating mixing was carried out with the Henschel mixer, and abrasives were obtained.

[0059] By sandblasting processing which used this abrasive material, without damaging a septum, when septum formation of PDP was performed, there is also no side edge and it was able to be processed with a sufficient precision. Moreover, it rubs in, there is also no phenomenon and the effectiveness which raises the separation efficiency of the low melting glass using magnetism to a septum peculiar to metal abrasives and metal abrasives, such as stainless steel, was acquired. furthermore, a blasting machine is suspended -- making -- one whole day and night -- starting of the blasting machine after neglect -- also being related -- a nozzle etc. -- also getting it blocked -- there is nothing and it has rebooted smoothly.

[0060] An example 8 substantia-compacta limestone is roasted, digested and carbonated. The maximum particle diameter of 75 micrometers, Manufacture a whisker-like calcium carbonate with a mean particle diameter of 2 micrometers, and stearin acid (TST: Miyoshi Oil & Fat Co., Ltd. make) is added 1.3% of the weight to the whisker-like calcium-carbonate particle fine-particles 100 weight section which is abrasives to this. By making into a fluid amelioration agent fumed silica (Reolosil CP-102: Tokuyama Soda Co., Ltd. make) whose mean particle diameter is furthermore 0.05 micrometers, it added

2% of the weight to the whisker-like calcium-carbonate particle fine-particles 100 weight section, heating mixing was carried out with the Henschel mixer, and abrasives were obtained.

[0061] By sandblasting processing which used these abrasives, when septum formation of PDP was performed, the inclination of a side edge was seen, a part of septum was damaged, and the precision of a septum was a little poor. About the restart after stopping a blasting machine and leaving it one whole day and night, it was a little difficult.

[0062] The glass bead with a mean particle diameter [example of comparison 1 / of 60 micrometers] and a maximum particle diameter of 74 micrometers was used. As a fluid amelioration agent, the white carbon (made in [chemistry incorporated company] star SHIRUS: Kami-shima) whose mean particle diameter is 0.03 micrometers was added 0.3% of the weight to the glass bead 100 weight section, heating mixing was carried out with the Henschel mixer, and abrasives were obtained.

[0063] By sandblasting processing which used these abrasives, when septum formation of PDP is performed, the septum has collapsed. Moreover, condensation of abrasives was unable to occur and restart the inside of a blasting machine, and near a nozzle about the restart after stopping a blasting machine and leaving it one whole day and night.

[0064] The glass bead adjusted to example of comparison 2 mean particle diameter of 10 micrometers and the maximum particle diameter of 105 micrometers was used. As a fluid amelioration agent, the white carbon (made in [chemistry incorporated company] star SHIRUS: Kami-shima) whose mean particle diameter is 0.03 micrometers was added 2% of the weight to the glass bead 100 weight section, heating mixing was carried out with the Henschel mixer, and abrasives were obtained.

[0065] By sandblasting processing which used these abrasives, when septum formation of PDP was performed, the part where a part of septum collapses occurred. Moreover, condensation of abrasives was unable to occur and restart the inside of a blasting machine, and near a nozzle about the restart after stopping a blasting machine and leaving it one whole day and night.

[0066] The glass bead adjusted to example of comparison 3 mean particle diameter of 20 micrometers and the maximum particle diameter of 62 micrometers was used. The white carbon (made in [chemistry incorporated company] star SHIRUS: Kami-shima) whose mean particle diameter is 0.03 micrometers was added 2% of the weight to the glass bead 100 weight section as a fluid amelioration agent to this, it mixed with the Henschel mixer to it, and abrasives were obtained to it.

[0067] Although the septum has been formed by sandblasting processing which used these abrasives when septum formation of PDP was performed, the inclination of a side edge was seen. Moreover, condensation of abrasives was unable to occur and restart the inside of a blasting machine, and near a nozzle about the restart after stopping a blasting machine and leaving it one whole day and night.

[0068] The glass bead adjusted to example of comparison 4 mean particle diameter of 15 micrometers and the maximum particle diameter of 44 micrometers was used as abrasives.

[0069] By sandblasting processing which used these abrasives, when septum formation of PDP was performed, the inclination of a strong side edge was seen and the septum was not able to be formed with a sufficient precision. Moreover, condensation of abrasives was unable to occur and restart the inside of a blasting machine, and near a nozzle about

the restart after stopping a blasting machine and leaving it one whole day and night.
[0070] The stainless steel powder adjusted to example of comparison 5 mean particle diameter of 25 micrometers and the maximum particle diameter of 150 micrometers was used as abrasives.
[0071] By sandblasting processing which used these abrasives, when septum formation of PDP was performed, the inclination of a side edge was seen, a part of septum was damaged, and the septum was not able to be formed with a sufficient precision. moreover, the septum which is the fault of metal abrasives -- it rubbed in and a phenomenon and adhesion occurred. Reuse of low melting glass of the separation efficiency of the low melting glass and metal abrasives, such as stainless steel, which furthermore used magnetism was not completed bad. About the restart after stopping a blasting machine and leaving it one whole day and night, it was a little difficult.
[0072]
[Table 1]

例	球状無機粒子	疎水性付与物質 (%)	流動性改良剤 (%)	B 平均粒子径(μm)	A 最大粒子径(μm)	球形指数 (%)	再起動性	加工精度
実施例1	ガラスビーズ	1	0.5	26	53	98	可能	良好
実施例2	ガラスビーズ	0.5	1	30	53	98	可能	良好
実施例3	アランダム	2	0	20	44	96	可能	良好
実施例4	カーボランダム	3	0.3	15	37	97	可能	良好
実施例5	ガラスビーズ	0.1	0.3	35	74	98	可能	良好
実施例6	ガラスビーズ	3	2	10	74	99	可能	良好
実施例7	ステンレス	0.4	0	20	52	58	可能	良好
実施例8	炭酸カルシウム	1.3	2	2	75	32	やや困難	やや不良
比較例1	ガラスビーズ	0	0.3	60	74	99	不可	不能
比較例2	ガラスビーズ	0	2	10	105	98	不可	不良
比較例3	ガラスビーズ	0	2	20	62	98	不可	やや不良
比較例4	ガラスビーズ	0	0	15	44	98	不可	不良
比較例5	ステンレス	0	0	25	150	55	やや困難	不良

A:球状無機粒子の最大粒子径(μm)
B:球状無機粒子の平均粒子径(μm)
C:研削最小溝幅(μm)
(註)
10≦A≦80 (μm)
3≦B≦50 (μm)
C=1000 (μm)

[Translation done.]

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(54)【発明の名称】　乾式ブラスト加工用研磨材

(57)【要約】
【課題】　水分に起因する研磨材の凝集、固結及び被研磨物への付着等のトラブルを効果的に防止するとともに、研磨効率及び加工精度の高い研磨材を提供する。
【解決手段】　球状無機粒子に撥水性を付与する物質を表面処理してなることを特徴とする。

【特許請求の範囲】
【請求項1】 球状無機粒子に撥水性を付与する物質を表面処理してなることを特徴とする乾式ブラスト加工用研磨材。
【請求項2】 球状無機粒子の平均粒子径の10分の1以下の平均粒子径からなる流動性改良剤を、球状無機粒子に対して0.01～5重量%添加してなる請求項1記載のブラスト加工用研磨材。
【請求項3】 球状無機粒子が下記式（1）～（3）を満足する請求項1または2記載の研磨材。
$10 \leqq A \leqq 0.8C$ （1）
$0.02C \leqq B \leqq 0.5C$ （2）
$50 \leqq C \leqq 1000$ （3）
但し、
A：球状無機粒子の最大粒子径（μm）
B：球状無機粒子の平均粒子径（μm）
C：研削最小溝幅（μm）
【請求項4】 半導体の酸化被膜の除去に用いる請求項1～3のいずれか1項に記載の研磨材。
【請求項5】 PDPの背面基板上へのリブ材の形成に用いる請求項1～3のいずれか1項に記載の研磨材。
【請求項6】 太陽電池素子の直列接続用スクライブラインの形成に用いる請求項1～3のいずれか1項に記載の研磨材。
【発明の詳細な説明】
【0001】
【発明の属する技術分野】本発明は、乾式の精密なサンドブラスト加工に用いられる、球状無機粒子を用いた研磨材に関し、更に詳しくは、水分に起因する研磨材の凝集、固結及び被研磨物への付着等のトラブルを効果的に防止するとともに、研磨効率及び加工精度に優れた研磨材に関する。
【0002】
【従来の技術】ブラスト加工は、被加工物の表面に研削材粒子を高速で噴射し、被加工物表面を研削したり表面に付着した汚れを除去したり、被加工物表面に衝撃力を与えてその表面の特性を改良するために広く使われる工業的手法である。最近は、この手法が従来考えられなかった数10μmの微細領域の加工に用いられるようになってきている。例えば、プラズマディスプレイパネル（以下、PDPと記す）の隔壁を形成する方法にもサンドブラスト法が有力な手法として取り上げられ、一部では実用段階にある。電極が設けられたガラス基板上にブラスト性を有する厚さ1mm以下の低融点ガラス層を形成し、該低融点ガラス層に幅50～1000μmといった微細な溝をガラス基板あるいはガラス基板上の電極の深さまで研削する。この場合、溝幅はマスキングテープの表面側に研磨材を噴射してブラスト加工することにより、低融点ガラス層を研削し、隔壁を形成する。この隔膜は後の工程で焼成されて無機質のガラス隔壁となる。この隔壁の間の空間に蛍光体等が設置されPDPとされる。
【0003】また、複数の太陽電池素子を電気的に直列接続させる太陽電池の製造において、太陽電池素子毎に分離・集積する方法として、所定のパターンで開口部が形成された透明導電膜、光電変換層、裏面電極など各々の導電膜上に、研磨材である微粒子粉体をガス流として吹き付け、開口部に露出した導体膜をスクライブするためのサンドブラスト法が試みられている。同様に、高密度実装された多層配線板のためバイアホール加工や、半導体回路素子の酸化被膜除去等の電気的な接続を得るための微細な研削にもサンドブラスト法が試みられている。
【0004】上記したPDP背面基板の隔壁形成あるいは太陽電池などの電極や半導体の酸化皮膜の除去に使用されるサンドブラスト法では、噴射された研磨材は、研削屑（研削されたペースト材あるいは皮膜形成物）とともに、研削部分から排除され、篩等の分離工程を得て回収され、リザーバタンク等に一次貯蔵され、ブラスト加工に再使用される。研磨材粒子として、目的に応じて、各種組成のガラスビーズ、アランダム、コランダム、セラミックビーズ、ステンレス、銅等が提案され、また現に使用されている。これらの粒子形状は、球形もしくは球形に近い形状が好ましいとされている。
【0005】研磨材として球形もしくは球形に近い形状の粒子が使用される利点としては、研磨材の製造過程において粗大粒子の除去が簡単であり、またブラスト加工における被加工物への付着性がなく、流動性が良く、研磨材の摩損が少ないことである。
【0006】しかし乍ら、平均粒径が数10μm～数μmの無機研磨材をサンドブラスト法に用いると、例え研磨材粒子の形状が真球に極めて近いものであっても、流動性が良くなかったり、装置を一度停止した後、しばらくして再起動しようとした時など供給タンクからノズルまでの研磨材の搬送回路の途中で全く流動しなくなる場合が起こる。このような場合、詰まっている部分に衝撃を加えると、研磨材が流動を開始する場合もあるが、多くの場合は、装置を分解する等して、装置内の研磨材を全て排除した後、新しい研磨材に一部あるいは全部を入れ替えて再起動することになり、作業性、生産性に著しい支障となっている。特に複数のノズル（研磨材噴射部分）を備え、研磨材の回収装置を組み込んだ大型のブラスト装置では、研磨材の入れ替えには、多大な時間と労力が必要とされる。
【0007】この原因は、静電気除去の方策が施された装置でも研磨材の閉塞が起こることから、ブラスト加工中、あるいは停止中に微量な水分が経時的な偏在を起こし、結果として研磨材粒子の各々の接触部や一部の微細な研削屑と研磨材粒子の間で液架橋を起こすことによると推定されている。

【0008】すなわち、ブラストマシンによるサンドブラスト加工においては研磨材が噴射ノズルから高圧、高速で噴射され、ノズル先端部では噴射による低温部分が生じ、温度差による水滴がノズル先端部に発生する。そして、ブラストマシン停止後、このマシン内の水分により研磨材が凝集するケースがしばしば発生する。また、特に大型のサンドブラスト装置においては、マシン内の研磨材の凝集、固化によりノズル先端部およびマシン内の研磨材を再起動するために一旦系外に排出しなければならない。こういった作業は生産効率を引き下げるばかりではなく、マシンがクリーンルーム内に存在する場合は困難を極めることになる。また、ブラストマシンの噴射ノズル先端部に発生した水分が研磨材のバインダーとして作用し、被研削物表面に研磨材が付着する現象が発生するケースも報告されている。

【0009】一方、PDPの隔壁形成のような、溝幅に比べて溝深さが深い研削では、研磨材粒子が、球形あるいは球形に近い形状であるが故に、ある程度研削が進み溝が掘成されてくると、研磨材粒子が被研磨物の溝底部ではねかえって溝壁面に衝突したりするため隔壁（または溝）の形状が一定になりにくい（サイドエッジが大きくなる）という問題もある。この問題は、研磨材の噴射圧力を弱めればかなり改善できるが、結果として研削速度を犠牲にすることになる。

【0010】さらには、研磨材粒子の大きさに関して、大きな研磨材粒子ほど質量が大きいので研削速度が大きいが、研磨材粒子の曲率が大きいため微細な加工が困難であることなどから、定性的な選定が行われているのが現状である。しかし、研磨材には被加工物の形状に応じて加工精度が高くかつ加工速度を大きくし得る粒度構成があるはずである。

【0011】以上のように、サンドブラスト法による微細加工では、作業効率に関して重要な要因となる研磨材の流動性、特に再起動時の流動性の確保や、加工精度と作業効率の両方に影響するサイドエッジの解消や、高精度で作業効率の良い研磨材が求められている。

【0012】

【発明が解決しようとする課題】本発明は上記実情に鑑みてなされたもので、その課題は、上記問題点を解消し、特にPDPの隔壁形成加工および太陽電池のスクライブラインの研削など半導体の酸化被膜の除去等に乾式において好適に使用され、被加工物底部表面の性状を損なうことなく、効率良く且つ精度良く研削しうるとともに、水分に起因する研磨材粒子の凝集を防止し、例えば、少なくとも一昼夜の間ブラストマシンを停止した後でも再起動可能な研磨材を提供することにある。

【0013】

【課題を解決するための手段】本発明者らは、鋭意検討した結果、球状無機粒子に撥水性を付与する物質を表面処理することにより、研磨材粒子の水分に起因する液架橋現象による凝集を防止し、例えば、一昼夜以上ブラストマシンを停止した後でも再起動可能な研磨材を提供でき、さらに、粒子径の10分の1以下の径からなる微粒子を研磨材粒子に対して添加することにより流動性の改善をはかり、研削最小溝幅（μm）、研磨材の形状、最大粒子径、平均粒子径等を制御することにより、超精密加工が必要な半導体分野等で使用可能な研磨材を見出し、本発明に到達した。

【0014】すなわち、本発明は、球状無機粒子に撥水性を付与する物質を表面処理してなることを特徴とする乾式ブラスト加工用研磨材を内容とする（請求項1）。尚、本発明において、研削という用語は、研削の他に研掃をも含む用語として使用する。

【0015】好ましい態様として、球状無機粒子の平均粒子径の10分の1以下の平均粒子径からなる流動性改良剤を、球状無機粒子に対して0．01～5重量%添加してなる請求項1記載の研磨材である（請求項2）。

【0016】好ましい態様として、球状無機粒子が下記式（1）～（3）を満足する請求項1または請求項2記載の研磨材である（請求項3）。

$10 \leqq A \leqq 0.8C$　（1）

$0.02C \leqq B \leqq 0.5C$　（2）

$50 \leqq C \leqq 1000$　（3）

但し、

A：研磨材の最大粒子径（μm）

B：研磨材の平均粒子径（μm）

C：研削または研掃する最小溝幅（μm）

【0017】好ましい態様として、半導体の酸化被膜の除去に用いる請求項1～3のいずれか1項に記載の研磨材である（請求項4）。

【0018】好ましい態様として、PDPの背面基板上へのリブ材の形成に用いる請求項1～3のいずれか1項に記載の研磨材である（請求項5）

【0019】好ましい態様として、太陽電池素子の直列接続用スクライブラインの形成に用いる請求項1～3のいずれか1項に記載の研磨材である（請求項6）。

【0020】

【発明実施の形態】以下、本発明について詳細に説明する。本発明は、球状無機粒子に撥水性を付与する物質を表面処理してなることを特徴とする乾式ブラスト加工用研磨材であることを特徴とし、これにより水分に起因する粒子間液架橋現象による研磨材の凝集、固結又は研磨材の被加工物への付着を効果的に防止でき、研削効率、研削精度を大巾に向上させることができる。

【0021】本発明に用いられる球状無機粒子としては、例えばガラスビーズ、アランダム、コランダム、セラミックビーズ、ステンレス、銅等の球状無機粒子粉体が挙げられる。本発明において、球状とは、下記式（4）で定義されるように、粒子投影面積の外接円に対する面積率が好ましくは50%以上、より好ましくは8

0%以上の場合を云う。

$$\text{外接円に対する面積率（\%）} = \frac{\text{粒子の投影面積}}{\text{粒子投影面積の外接円の面積}} \times 100 \quad (4)$$

【0022】本発明に用いられる撥水性を付与する物質としては、撥水性を付与する物質であれば特に限定されることなく用いることが出来る。具体的に例示すると、オレイン酸、ラウリン酸、ミリスチン酸、ミリスチン酸イソトリデシル、パルミチン酸、ベヘニン酸、ステアリン酸、イソステアリン酸等の脂肪酸；前記脂肪酸のアマイドおよびビスアマイド；ステアリルアルコール等の高級アルコールまたは分岐高級アルコール；一価アルコールの高級脂肪酸エステル、多価アルコールの高級脂肪酸エステル、モンタンワックスタイプの非常に長鎖のエステルまたはその部分加水分解物等の脂肪酸エステル系滑剤；ステアリン酸バリウム、ステアリン酸カルシウム、ステアリン酸アルミニウム、ステアリン酸亜鉛、ステアリン酸マグネシウムまたはその複合体等の金属石鹸系滑剤；C_{16}以上の流動パラフィン、マイクロクリスタリンワックス、天然パラフィン、合成パラフィン、ポリオレフィンワックスおよびこれらの部分酸化物、フッ化物、塩化物などの脂肪族炭化水素系滑剤；シリコンオイル、大豆油、ヤシ油、パーム核油、アマニ油、ナタネ油、綿実油、キリ油、ヒマシ油、牛脂、スクワラン、ラノリン、硬化油等の油剤；ＨＬＢが9以下の界面活性剤、例えばＮ－アシルアミノ酸塩、アルキルエーテルカルボン酸塩、アシル化ペプチド等のカルボン酸塩；アルキルスルホン酸塩、アルキルベンゼンおよびアルキルナフタレンスルホン酸塩、スルホンコハク酸塩、α－オレフィンスルホン酸塩、Ｎ－アシルスルホン酸塩等のスルホン酸塩；硫酸化油、アルキル硫酸塩、アルキルエーテル硫酸塩、アルキルアリルエーテル硫酸塩、アルキルアミド硫酸塩等の硫酸エステル塩；アルキルリン酸塩、アルキルエーテルリン酸塩、アルキルアリルエーテルリン酸塩等のリン酸エステル塩等の陰イオン界面活性剤；脂肪族アミン塩、脂肪族４級アンモニウム塩、ベンザルコニウム塩、塩化ベンゼトニウム、ピリジニウム塩、イミダゾリニウム塩等の陽イオン界面活性剤；カルボキシベタイン型、アミノカルボン酸塩、イミダゾリニウムベタイン、レシチン等の両性界面活性剤；ポリオキシエチレンアルキルエーテル、ポリオキシエチレン２級アルコールエーテル、ポリオキシエチレンアルキルフェニルエーテル、ポリオキシエチレンステロールエーテル、ポリオキシエチレンラノリン誘導体、アルキルフェノールホルマリン縮合物の酸化エチレン誘導体、ポリオキシエチレンポリオキシプロピレンブロックポリマー、ポリオキシエチレンポリオキシプロピレンアルキルエーテル、ポリオキシエチレングリセリン脂肪酸エステル、ポリオキシエチレンヒマシ油および硬化ひまし油、ポリオキシエチレンソルビタン脂肪酸エステル、ポリオキシエチレンソルビトール脂肪酸エステル、ポリエチレングリコール脂肪酸エステル、脂肪酸モノグリセリド、ポリグリセリン脂肪酸エステル、ポリグリセリン脂肪酸エステル、ソルビタン脂肪酸エステル、脂肪酸アルカノールアミド、ポリオキシエチレン脂肪酸エステルアミド、ポリオキシエチレンアルキルアミン、アルキルアミンオキサイド等の非イオン界面活性剤；フッ素系界面活性剤；ポリオキシエチレンアリルグリシジルノニルフェニルエーテル等の反応系界面活性剤；γ－クロロプロピルトリメトキシシラン、ビニルトリエトキシシラン、ビニルトリメトキシシラン、ビニル・トリス（β－メトキシエトキシ）シラン、γ－メタクリロキシプロピルトリメトキシシラン、β－（３，４－エポキシシクロヘキシル）エチルトリメトキシシラン、γ－グリシドキシプロピルトリメトキシシラン、γ－メルカプトプロピルトリメトキシシラン、γ－アミノプロピルトリエトキシシラン、Ｎ－β－（アミノエチル）－γ－アミノプロピルトリメトキシシラン、γ－ユレイドプロピルトリエチキシシラン等のシランカップリング剤；イソプロピルトリイソステアロイルチタネート、イソプロピルトリ－ｎ－ドデシルベンゼンスルホニルチタネート、イソプロピルトリス（ジオクチルピロホスファイト）チタネート、　テトライソプロピルビス（ジトリデシルフォスファイト）チタネート、テトラ（２，２－ジアリルオキシメチル－１－ブチル）ビス（ジ－トリデシル）フォスファイトチタネート、ビス（ジオクチルピロホスフェート）エチレンチタネート、イソプロピルトリ（Ｎ－アミノエチル－アミノエチル）チタネート等のチタンカップリング剤が挙げられ、これらは単独で又は２種以上組み合わせて用いられる。中でも安価なステアリン酸が好ましい。

【0023】撥水性を付与する物質の表面処理量は、球状無機粒子に対して０．０１～５重量%の範囲が好ましく、特に０．１～４重量%がより好ましい。撥水性を付与する物質の表面処理量が０．０１重量%未満では表面処理効果が十分でなく、一方、５重量%を越えても表面処理効果が向上せず経済的でないばかりでなく、却って被研磨物の物性を損なう場合がある。

【0024】本発明の研磨材は、上記表面処理粒子に、球状無機粒子の平均粒子径の１０分の１以下の平均粒子径からなる流動性改良剤を添加混合することにより、ブラストマシン内における流動性、ブラスト加工時における研磨材の分散性を一層向上させ、ブラスト加工終了時における被加工物への残留性を一層低減せしめることが可能となる。流動性改良剤を具体的に例示すると、タル

ク、無水珪酸、ベントナイト、カオリン、酸化マグネシウム、炭酸マグネシウム、珪酸マグネシウム、酸化亜鉛、水酸化マグネシウム、コロイダルシリカ、珪藻土、ステアリン酸マグネシウム、溶融シリカ粉、ヒュームドシリカ、シリカ、コンスターチ、でん粉、珪酸カルシウム等の超微粉末が挙げられ、これらは単独で又は２種以上組み合わせて用いられる。中でも改善効果の高い点で無水珪酸とコロイダルシリカが好ましい。流動性改良剤の添加量は、研磨材である球状無機粒子に対して０．０１～５重量%の範囲が好ましく、特に０．１～４重量%がより好ましい。流動性改良剤の添加量が０．０１重量%未満では添加効果が十分でなく、一方、５重量%を越えると却って添加効果が損なわれる。

【００２５】尚、流動性改良剤を添加混合するに際し、球状無機粒子に表面処理された撥水性を付与する物質をバインダーとして利用し、該バインダーを介して球状無機粒子表面に流動性改良剤を付着させることもできる。この場合には、流動性改良剤がクッション材としての機能を果たし、研削時における研磨材の反発力を抑えることにより、ＰＤＰの隔壁形成におけるサイドエッジを防止したり、太陽電池製造におけるスクライブ精度を向上させる効果が得られる。更に、ブラストマシン内における流動性、ブラスト加工時における研磨材の分散性を一層向上させ、加えてこれら、ブラスト加工終了時における該被加工物上への研磨材の残留性を低減せしめる効果がある。

【００２６】また、ブラスト加工を行う上で、これら研磨材の粒子径に対し、研削最小溝幅（研掃の場合は最小研掃溝幅）Ｃ（μｍ）に応じて、好ましい最大粒子径が存在し、本発明の研磨材は、研磨材を構成する球状無機粒子の最大粒子径Ａ（μｍ）が研削最小溝幅Ｃ（μｍ）との関係において、好ましくは下記式（１）、より好ましくは下記式（５）、更に好ましくは下記式（６）を満足するように球状無機粒子を選定する。

【００２７】$10 \leqq A \leqq 0.8C$　（１）

$11 \leqq A \leqq 0.7C$　（５）

$12 \leqq A \leqq 0.6C$　（６）

【００２８】すなわち、球状無機粒子中の最大粒子径が０．８Ｃを越えると研削する溝幅より大きな粒子が存在する確率が高くなり、ある程度研削された溝に、大きな研磨材粒子が挟まり、その結果、粒子が挟まった部分の下部の研削を妨げ、場合によっては隔壁の破損を生じさせ、加工精度および生産効率の低下を引き起こす傾向がある。また、球状無機粒子の最大粒子径が１０μｍより小さくなると、球状無機粒子の平均粒子径も極端に小さくなり、研磨材粒子一個の研削能力が低下し、研削効率のよい研磨材が得られない傾向がある。すなわち、上記構成とすることにより、隔壁の破損が防止され、隔壁の精度が著しく向上する。

【００２９】また、球状無機粒子の平均粒子径は、ブラスト加工時における、加工速度および研磨材の分散性に影響を及ぼす。これらの特性を考慮して、本発明では、球状無機粒子の平均粒子径Ｂ（μｍ）は、最小研削溝幅Ｃ（μｍ）との関係において、好ましくは下記式（２）、好ましくは下記式（７）、更に好ましくは下記式（８）を満足するように選定する。

【００３０】$0.02C \leqq B \leqq 0.5C$　（２）

$0.04C \leqq B \leqq 0.4C$　（７）

$0.05C \leqq B \leqq 0.3C$　（８）

【００３１】すなわち、ＰＤＰのサンドブラスト法を用いた隔壁形成や太陽電池のスクライブラインの如く精密なブラスト研削加工においては、研削最小溝幅Ｃに応じて、好ましい平均粒子径が存在するのである。平均粒子径が０．５Ｃを越えた場合は、研磨材粒子の１個あたりの質量が増大し、粒子の１回の衝突における研削力も増大するが、その結果、被加工物底部であるガラス等からなる基板上に設けられた電極及び基板表面に損傷を与える危険率も大きくなる傾向がある。また、平均粒子径が、０．０２Ｃより小さいと研磨材粒子の１個当たりの質量も小さくなり、粒子の１回の衝突における研削力も減少する傾向がある。その結果、ＰＤＰの場合、被加工物底部であるガラス等からなる基板上に設けられた電極及び基板表面に損傷を与える危険性は回避出来るが、研磨効率は著しく低下する場合がある。すなわち、上記の構成とすることにより、最小加工溝幅が小さくなっても、研磨効率を保持することが出来る。また、太陽電池のスクライブ加工についても同様のことが言える。尚、球状無機粒子の最大粒子径及び平均粒子径は、撥水性を付与する物質を表面処理した球状無機粒子、すなわち研磨材粒子の最大粒子径及び平均粒子径と殆ど変わらず実質的に同じである。

【００３２】サンドブラスト法を用いたＰＤＰの隔壁形成及び太陽電池のスクライブラインの研削加工における最小加工溝幅Ｃは、通常、主に５０～１０００μｍの範囲でブラスト加工されており、本発明でもこの範囲が好適である。

【００３３】上記した如く、撥水性を付与する物質で表面処理した表面処理粒子、又は更に該表面処理球状無機粒子に流動性改良剤を添加してなる研磨材、さらに研削最小溝幅に対する最大粒子径、平均粒子径等を制御した本発明の研磨材は、半導体分野の酸化被膜の除去等に好適に使用できる。例えば、ＴＦＴパネルの高精細化、高開口率化の為、一層の微細加工が求められており、従来湿式で行われてきた研磨方法が乾式に移行しつつあるが、本発明の研磨材はこの乾式研磨方法に有効に適用でき、特にメタルや酸化膜などの高いエネルギーが必要な研磨において効率が良く且つ精度も良好である。

【００３４】また、上記本発明の研磨材は、効率及び精度の良いＰＤＰ背面基板の隔壁形成用研磨材として適用できる。ＰＤＰの隔壁形成過程においては、サンドブラ

スト法により隔壁が形成されており、ガラス基板上にブラスト性を有するリブ材層を設け、耐ブラスト性を有する樹脂層によりパターニングが施され、上方からブラスト加工することにより隔壁が形成される。

【００３５】さらに、上記本発明の研磨材は、効率及び精度の良い太陽電池スクライブ加工用研磨材として適用できる。

【００３６】以上のように、本発明の研磨材は、撥水性を付与する物質で表面処理されているので、水分に起因する研磨材の凝集、固結及び被研磨物への付着等のトラブルを効果的に防止し、例えば、ＰＤＰパネルの隔壁形成工程、太陽電池のスクライブ加工等に際し、目的とする研削最小溝幅に応じて、最大粒子径、平均粒子径を制御することにより、研磨効率及び加工精度の高い研磨材として有用である。

【００３７】また、本発明の研磨材は、撥水性を付与する物質によって表面処理を行うことにより液架橋による球状無機粒子粉体の凝集防止効果が得られるばかりでなく、金属研磨剤等による被加工物への擦り込み防止効果が得られる。例えば、ＰＤＤパネル背面基板の製造工程においてステンレス粉等が使用される場合、被研磨物である白色の低融点鉛ガラス等からなる隔壁が金属研磨剤による擦り込みにより変色し、ＰＤＰの輝度を低下させるといったケースが発生しているが、このようなトラブルが防止される。さらには、磁力を利用した低融点ガラスとステンレス等の金属研磨材との分離効率を高める効果が得られる。これにより被研磨物である低融点ガラスの再生利用が可能になり、ＰＤＰの製造コスト低減をはかることが可能になる。

【００３８】

【実施例】以下、本発明を実施例、比較例を挙げて更に具体的に説明するが、本発明の範囲は、これらにより何ら制限を受けるものではない。尚、被研磨物として、下記の隔壁形成方法に従い、実験用のＰＤＰ背面パネルを使用し、研磨材の噴射圧力、時間当たりの噴射重量を一定に調節して隔壁形成試験を行い、被加工物底部のガラス基盤の表面性状および隔壁形状を観察した。

【００３９】隔壁形成方法：

（Ａ）実験用ＰＤＰ背面パネルの製造：ソーダライムガラス基板上に、電極を形成（電極表面は酸化マグネシウム層で保護）し、その上に低融点ガラスペーストをコーターで塗布し乾燥後、その表面に耐ブラスト性を有するマスク材で研削溝幅（一定、すなわち隔壁間隔一定）が１００μｍである隔壁パターンを形成した。

【００４０】（Ｂ）ブラスト加工：上記の如く製造した実験用ＰＤＰ背面パネルを使用し、下記の実施例、比較例の各種研磨材による研削実験を行った。加工条件を下記の通りに設定し、各種研磨材の隔壁形成時間を測定し、隔壁形状及び研磨精度を観察した。

噴射ノズル口径：１０ｍｍ

研磨材噴射圧力：３．０ｋｇ／ｃｍ² （２９０ｋＰａ）

研磨材噴射量：１００ｇ／ｍｉｎ

パネルまでの距離：１０ｃｍ

【００４１】被研磨物として、ＰＤＰ試験用の背面基盤を使用し、ブラストマシンの噴射圧力、研磨剤の時間あたりの噴射重量を一定に調節し、隔壁形成試験を行い、加工精度を被加工物底部のガラス基盤の表面性状および隔壁形状を観察することにより評価した。また、再起動性の可否についても評価した。表１に球状研磨材の組成及び評価結果を示す。尚、表１中の研磨材粒子の特性の測定方法及び評価は下記の方法で行った。

【００４２】研磨材を構成する無機粒子粉体の最大粒子径、平均粒子径は、日機装株式会社マイクロトラックＦＲＡを使用して測定した。

【００４３】研磨効率の評価としては、同噴射圧力による各研磨材の切削速度を（秒）を計測した。

【００４４】球形を示す指数は電子顕微鏡写真写った粒子をランダムに２０点選択して測定した値の平均値を算出した。

【００４５】加工精度は、電子顕微鏡を用いて、研磨後のＰＤＰ背面パネルの溝底部の傷、溝やそのサイドエッジの表面性状を目視観察し、下記基準により評価した。

良好：傷がなく、溝の加工形状が均一でサイドエッジがない。

やや不良：少し傷がある、及び／又は、溝の加工形状がやや不均一でサイドエッジの傾向が若干見られる。

不良：多くの傷がある、及び／又は、溝の加工形状が不均一でサイドエッジが発生している。

不能：加工による隔壁形成ができない。

【００４６】実施例１

平均粒子径２６μｍ、最大粒子径５３μｍのガラスビーズを使用し、これに、撥水性を付与する物質として、ステアリン酸（ＴＳＴ：ミヨシ油脂株式会社製）をガラスビーズ１００重量部に対して１重量％添加し、さらに流動性改良剤として、平均粒子径が０．０３μｍのホワイトカーボン（スターシルーＳ：神島化学株式会社製）をガラスビーズ１００重量部に対して０．５重量％添加し、ヘンシェルミキサーで加熱混合し研磨材を得た。

【００４７】この研磨材を使用したサンドブラスト加工により、ＰＤＰの隔壁を形成したが、隔壁を損傷することなく精度良く加工することができた。また、ブラストマシンを停止させ一昼夜放置後のブラストマシンの始動に関しても、ノズル等につまりが無く再起動できた。

【００４８】実施例２

平均粒子径３０μｍ、最大粒子径５３μｍのガラスビーズを使用し、これに、撥水性を付与する物質として、ステアリン酸（ＴＳＴ；ミヨシ油脂株式会社製）をガラスビーズ１００重量部に対し０．５重量％添加し、さらに流動性改良剤として、平均粒子径が０．０３μｍのホワイトカーボン（スターシルーＳ：神島化学株式会社製）

をガラスビーズ１００重量部に対して１重量%添加しヘンシェルミキサーで加熱混合し研磨材を得た。

【００４９】この研磨材を使用したサンドブラスト加工により、ＰＤＰの隔壁形成を行ったが隔壁を損傷することなく精度良く加工することができた。また、ブラストマシンを停止させ一昼夜放置後のブラストマシンの始動に関しても、ノズル等につまりも無くスムーズに再起動できた。

【００５０】実施例３

平均粒子径２０μｍ、最大粒子径４４μｍのアランダムを使用し、これに、撥水性を付与する物質として、ステアリン酸（ＴＳＴ；ミヨシ油脂株式会社製）をアランダム１００重量部に対し２重量%添加し、ヘンシェルミキサーで加熱混合し研磨材を得た。

【００５１】この研磨材を使用したサンドブラスト加工により、ＰＤＰの隔壁形成を行ったが隔壁を損傷することなく精度良く加工することができた。また、ブラストマシンを停止させ一昼夜放置後のブラストマシンの始動に関しても、ノズル等につまりも無くスムーズに再始動できた。

【００５２】実施例４

平均粒子径１５μｍ、最大粒子径３７μｍのカーボランダムを使用し、これに、撥水性を付与する物質として、ステアリン酸（ＴＳＴ：ミヨシ油株式会社製）をカーボランダム１００重量部に対し３重量%添加し、さらに流動性改良剤として、平均粒子径が０．０３μｍのホワイトカーボン（スターシルーＳ：神島化学株式会社製）をカーボランダム１００重量部に対して０．３重量%添加しヘンシェルミキサーで加熱混合し研磨材を得た。

【００５３】この研磨材を使用したサンドブラスト加工により、ＰＤＰの隔壁形成を行ったところ隔壁を損傷することなくサイドエッジもなく精度良く加工することができた。また、ブラストマシンを停止させ一昼夜放置後のブラストマシンの始動に関しても、ノズル等のつまりも無くスムーズに再起動できた。

【００５４】実施例５

平均粒子径３５μｍ、最大粒子径７４μｍのガラスビーズを使用した。これに、撥水性を付与する物質として、ステアリン酸（ＴＳＴ：ミヨシ油株式会社製）をガラスビーズ１００重量部に対し０．１重量%添加し、さらに流動性改良剤として、平均粒子径が０．０３μｍのホワイトカーボン（スターシルーＳ：神島化学株式会社製）をガラスビーズ１００重量部に対して０．３重量%添加しヘンシェルミキサーで加熱混合し研磨材を得た。

【００５５】この研磨材を使用したサンドブラスト加工により、ＰＤＰの隔壁形成を行ったところ隔壁を損傷することなくサイドエッジもなく精度良く加工することができた。また、ブラストマシンを停止させ一昼夜放置後のブラストマシンの始動に関しても、ノズル等のつまりも無くスムーズに再始動できた。

【００５６】実施例６

平均粒子径１０μｍ、最大粒子径７４μｍに調整したガラスビーズを使用した。これに、撥水性を付与する物質として、ステアリン酸（ＴＳＴ：ミヨシ油株式会社製）をガラスビーズ１００重量部に対し３重量%添加し、さらに流動性改良剤として、平均粒子径が０．０３μｍのホワイトカーボン（スターシルーＳ：神島化学株式会社製）をガラスビーズ１００重量部に対して２重量%添加しヘンシェルミキサーで加熱混合し研磨材を得た。

【００５７】この研磨材を使用したサンドブラスト加工により、ＰＤＰの隔壁形成を行ったところ隔壁を損傷することなくサイドエッジもなく精度良く加工することができた。また、ブラストマシンを停止させ一昼夜放置後のブラストマシンの始動に関しても、ノズル等のつまりも無くスムーズに再起動できた。

【００５８】実施例７

平均粒子径２０μｍ、最大粒子径５２μｍに調整したステンレス粉を使用した。これに、撥水性を付与する物質として、ステアリン酸（ＴＳＴ：ミヨシ油株式会社製）をステンレス粉１００重量部に対し０．４重量%添加し、ヘンシェルミキサーで加熱混合し研磨材を得た。

【００５９】この研磨剤を使用したサンドブラスト加工により、ＰＤＰの隔壁形成を行ったところ隔壁を損傷することなくサイドエッジもなく精度良く加工することができた。また、金属研磨材特有の隔壁への擦込み現象もなく、磁力を利用した低融点ガラスとステンレス等の金属研磨材との分離効率を高める効果が得られた。さらに、ブラストマシンを停止させ一昼夜放置後のブラストマシンの始動に関しても、ノズル等のつまりも無くスムーズに再起動できた。

【００６０】実施例８

緻密質石灰石を焙焼、消化、炭酸化し、最大粒子径７５μｍ、平均粒子径２μｍのウイスカー状炭酸カルシウムを製造し、これにステアリン酸（ＴＳＴ：ミヨシ油脂株式会社製）を研磨材であるウイスカー状炭酸カルシウム粒子粉体１００重量部に対して１．３重量%添加し、さらに平均粒子径が０．０５μｍのヒュームドシリカ（レオロシールＣＰ－１０２：徳山曹達株式会社製）を流動性改良剤としてウイスカー状炭酸カルシウム粒子粉体１００重量部に対して２重量%添加し、ヘンシェルミキサーで加熱混合し研磨材を得た。

【００６１】この研磨材を使用したサンドブラスト加工により、ＰＤＰの隔壁形成を行ったところサイドエッジの傾向がみられ、隔壁が一部損傷し、隔壁の精度はやや不良であった。ブラストマシンを停止させ一昼夜放置した後の再始動については、やや困難であった。

【００６２】比較例１

平均粒子径６０μｍ、最大粒子径７４μｍのガラスビーズを使用した。流動性改良剤として、平均粒子径が０．０３μｍのホワイトカーボン（スターシルーＳ：神島化

学株式会社製）をガラスビーズ１００重量部に対して０．３重量%添加しヘンシェルミキサーで加熱混合し研磨材を得た。

【００６３】この研磨材を使用したサンドブラスト加工により、ＰＤＰの隔壁形成を行ったところ隔壁が崩壊してしまった。また、ブラストマシンを停止させ一昼夜放置した後の再始動については、ブラストマシン内およびノズル付近に研磨材の凝集が発生し、再始動することは不可能であった。

【００６４】比較例２

平均粒子径１０μｍ、最大粒子径１０５μｍに調整したガラスビーズを使用した。流動性改良剤として、平均粒子径が０．０３μｍのホワイトカーボン（スターシルーＳ：神島化学株式会社製）をガラスビーズ１００重量部に対して２重量%添加しヘンシェルミキサーで加熱混合し研磨材を得た。

【００６５】この研磨材を使用したサンドブラスト加工により、ＰＤＰの隔壁形成を行ったところ隔壁が一部崩壊する箇所が発生した。また、ブラストマシンを停止させ一昼夜放置した後の再始動については、ブラストマシン内およびノズル付近に研磨材の凝集が発生し、再始動することは不可能であった。

【００６６】比較例３

平均粒子径２０μｍ、最大粒子径６２μｍに調整したガラスビーズを使用した。これに流動性改良剤として、平均粒子径が０．０３μｍのホワイトカーボン（スターシルーＳ：神島化学株式会社製）をガラスビーズ１００重量部に対して２重量%添加しヘンシェルミキサーで混合し研磨材を得た。

【００６７】この研磨材を使用したサンドブラスト加工により、ＰＤＰの隔壁形成を行ったところ、隔壁は形成できたがサイドエッジの傾向がみられた。また、ブラストマシンを停止させ一昼夜放置した後の再始動については、ブラストマシン内およびノズル付近に研磨材の凝集が発生し、再始動することは不可能であった。

【００６８】比較例４

平均粒子径１５μｍ、最大粒子径４４μｍに調整したガラスビーズを研磨材として使用した。

【００６９】この研磨材を使用したサンドブラスト加工により、ＰＤＰの隔壁形成を行ったところ、強いサイドエッジの傾向がみられ、精度良く隔壁は形成できなかった。また、ブラストマシンを停止させ一昼夜放置した後の再始動については、ブラストマシン内およびノズル付近に研磨材の凝集が発生し、再始動することは不可能であった。

【００７０】比較例５

平均粒子径２５μｍ、最大粒子径１５０μｍに調整したステンレス粉を研磨材として使用した。

【００７１】この研磨材を使用したサンドブラスト加工により、ＰＤＰの隔壁形成を行ったところ、サイドエッジの傾向がみられ、隔壁が一部損傷し、精度良く隔壁は形成できなかった。また、金属研磨材の欠点である隔壁への擦込み現象および付着が発生した。さらに磁力を利用した低融点ガラスとステンレス等の金属研磨材との分離効率は悪く低融点ガラスの再利用は出来なかった。ブラストマシンを停止させ一昼夜放置した後の再始動については、やや困難であった。

【００７２】

【表１】

例	球状無機粒子	疎水性付与物質 (%)	流動性改良剤 (%)	B 平均粒子径(μm)	A 最大粒子径(μm)	球形指数 (%)	再起動性	加工精度
実施例1	ガラスビーズ	1	0.5	26	53	98	可能	良好
実施例2	ガラスビーズ	0.5	1	30	53	98	可能	良好
実施例3	アランダム	2	0	20	44	96	可能	良好
実施例4	カーボランダム	3	0.3	15	37	97	可能	良好
実施例5	ガラスビーズ	0.1	0.3	35	74	98	可能	良好
実施例6	ガラスビーズ	3	2	10	74	99	可能	良好
実施例7	ステンレス	0.4	0	20	52	58	可能	良好
実施例8	炭酸カルシウム	1.3	2	2	75	32	やや困難	やや不良
比較例1	ガラスビーズ	0	0.3	60	74	98	不可	不能
比較例2	ガラスビーズ	0	2	10	105	98	不可	不良
比較例3	ガラスビーズ	0	2	20	62	98	不可	やや不良
比較例4	ガラスビーズ	0	0	15	44	98	不可	不良
比較例5	ステンレス	0	0	25	150	55	やや困難	不良

A:球状無機粒子の最大粒子径(μm)
B:球状無機粒子の平均粒子径(μm)
C:研削最小溝幅(μm)
(注)
10≦A≦80 (μm)
3≦B≦50 (μm)
C=1000 (μm)

【0073】
【発明の効果】以上のように、本発明の研磨材は、撥水性を付与する物質で表面処理されているので、水分に起因する研磨材の凝集、固結及び被研磨物への付着等のトラブルを効果的に防止し、例えば、ＰＤＰパネルの隔壁形成工程、太陽電池のスクライブ加工等に際し、目的とする研削最小溝幅に応じて、最大粒子径、平均粒子径を制御することにより、研磨効率及び加工精度の高い研磨材として有用である。